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13 August 1984

China Report

AGRICULTURE

HUNAN AGRICULTURAL GEOGRAPHY

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HUNAN AGRICULTURAL GEOGRAPHY

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HUNAN AGRICULTURAL GEOGRAPHY

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Chapter 1. Natural Conditions and Resources Potential

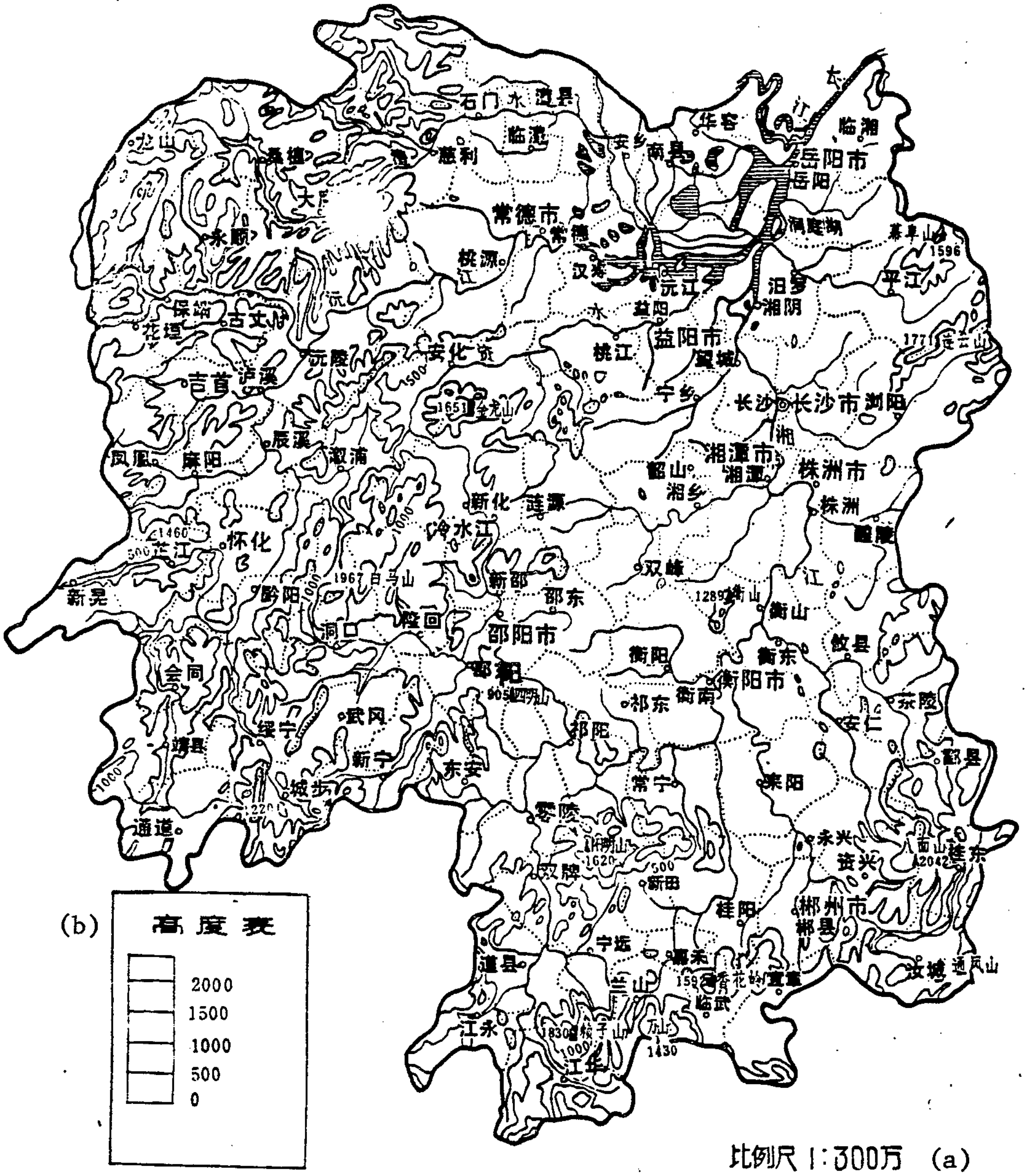
First Section. Geomorphology

Hunan Province is located in a transitional zone between the place where the Yunnan-Guizhou Plateau descends to the hills south of the Chang Jiang and where the Nanling mountainlands descend to the Jianghan Plain. It is a place where mountains and rivers alternatingly rise and fall, and where the types of landforms are varied, laying an important foundation for the formation of complex environmental conditions for agriculture, abundant natural resources, and striking regional differences.

1. Terrain Features and Soil Use

(1) Concave Basin Opening Toward the North

The contour of the terrain in Hunan Province is as follows: Fairly high in the west, the ridges of the Xuefeng and Wuling ranges reaching an elevation of about 1,500 meters. Most of the land gradually descends to hills and basins at an elevation of 500-200 meters in central Hunan, only to rise again in the eastern part of the province to an elevation of 1,000 meters in the mountainlands along the Hunan-Jiangxi border. In cross section, the terrain resembles a saddle that, relatively speaking, is characterized by high terrain in the west and gently sloping terrain in the east. The Wuling winds through the south, and the Shikengkongshi on the border between Hunan and Guangdong is 1,902 meters above sea level, while the top of Nanshan on the Hunan-Guangxi border is 1,941 meters above sea level. Moving northeastward, the terrain cascades downward in waves to the Binhai Plain, most of which is at below 50 meters above sea level, demonstrating that the terrain is high in the south and low in the north. The Dongting Hu region is the lowest point in the province with the terrain sloping toward it all around. It contains the four rivers [the Xiang, Zi, Yuan, and Li], and swallows up and disgorges the Chang Jiang forming a heart-shaped system. The overall view of the province is land rising to the west, south, and east from the Dongting Hu region, but gradually descending toward the center and toward the northeast to form a horse shoe-shaped incomplete basin opening toward the north. (Figure 2. Terrain Map of Hunan).



(b) (a)

Figure 2. Topographical Map of Hunan Province

Key:

a. Scale 1:3,000,000
b. Elevation

The foregoing terrain structure not only controls the water system pattern throughout the province, but also intensifies the extent of temperature changes. It favors the penetration and retention of cold waves, with the result that the province's winter temperatures tend to be low; spring temperatures vary greatly with a large number of overcast and rainy days. In summer, once the heat has risen it is not readily dissipated, and central

and northern Hunan become hot spots in the middle reaches of the Chang Jiang with a sharp drop in the amount of rainfall. The Xuefeng Shan, which cuts across the province, forms a natural line dividing the terrain, environmental conditions and nature between east and west in Hunan Province. In the course of a year, the average daily ≥15°C temperature line and the cumulative 4,200°C temperature line generally corresponds with the eastern foothills of the Xuefeng Shan, with heat being plentiful to the east of that line and scant to the west of it. Annual rainfall in the surrounding mountain region reaches 1,400-1,700 millimeters, and 1,200-1,300 millimeters in the hills and basins. The hydrothermal situation is influenced by the orographical line, which varies vertically and shows a change in deflection zone patterns.

(2) Alternating Mountain Ranges and Valleys, With Basins Crisscrossing

The eastern side of the Lianshao Hills, the Xuefeng Range, and the Wuling Range are watersheds that divide the basins of the Xiang, the Zi, the Yuan, and the Li rivers in Hunan Province. Mountain ranges alternate with river valleys, and basins crisscross the terrain, which rises gradually from the southeast to the northwest, the hills and broad valleys becoming transformed little by little into lofty mountains and majestic ranges. The basins of the four rivers account for an appreciable amount of the province's total area; the basin of the Xiang Jiang for 38.8 percent, the Zi Shui for 13.6 percent, the Yuan Shui for 26.2 percent, the Li Shui for 7.7 percent, and other rivers for 4.8 percent. Going up the Xiang Jiang from the Tong Ting Hu Plain, south to Hengyang, east to Liling, or west to Xiangxiang, the terrain is fairly flat and lies in long narrow tracts at an elevation below 50 meters above sea level. Southwestward to Qiyang and Lingling, and southward to Linzhou, including the Youxian, Chaling and the Yongxing basins tucked among the mountains, the land is below 200 meters above sea level. Some of the basins among the mountains in the stretch from Daoxian, Ningyuan, and Guiyang, as well as around Jiangyong and Linwu are at an elevation of from 200 to 400 meters above sea level. Jianghua, Lanshan, and Jiahe counties are higher than 500 meters above sea level. Along the banks of the upper reaches of the Zi Shui lie mostly low hills and small plains; mountain ranges and narrow valleys dominate the middle reaches; and the lower reaches contain mostly hills and alluvial tablelands. Thus, Yiyang marks the limit of the area along the river at 50 meters above sea level, and the 200 meter elevation stops at the area running from Xinhua to Shaodong, Xinshao, Shaoyang, Longhui and on to Dongkou and Xinning. These areas connect with partial basins and segmented plains like joints of a lotus root at an elevation of 200-400 meters above sea level. In the upper reaches of the Yuan Shui are precipitous mountains and gorges; and in the middle reaches are narrow, elongated hills and basins that spread out to become plains near the mouths of rivers. In the area between Changde and Taoyuan, elevation begins to go beyond 50 meters above sea level, reaching 200 meters at Qianyang and Shupu beyond which it rises to between 300 and 500 meters above sea level. The plain is very narrow. The Li Shui is shortest, and precipitous mountains crowd in from both sides of the valleys formed by its main stream and tributaries. Only in its lower reaches and near its mouth is the elevation at 100 to below 50 meters above sea level.

These features of the terrain of river basins and valleys substantially determine the extent of land development and use in the province, and variations from one region to another. The reclamation and cultivation index for the province as a whole averages 16.24 percent. It is higher for the north than the south and higher for the east than the west. (See Table 2) In lake areas, "diked fields" predominate, and cultivated land is concentrated in continuous tracts. Hill and river valley areas are crisscrossed with "fields having upraised paths," "alluvial fields," and "fields with low embankments around them." In mountain regions are large numbers of "cavern fields," "ravine fields," and "terraced fields." Basins surrounded by mountains or hills dot the province. The water system radiates like the branches of a tree, and cultivated land also spreads like the branches of a tree or like a series of partial rings. The drop of surrounding streams and the water impounded by embankments in individual sections of the streams may be used in multiple ways such as for irrigation and flood prevention.

Table 2. Reclamation and Cultivation Index for Separate Regions of Hunan Province (1979)

Region	Land Area (10,000 mu)	Cultivated Land Area (10,000 mu)	Average Reclamation and Cultivation Rate %
Total province	31,777.35	5,160.60	16.24
North Hunan	4,529.78	1,271.59	28.07
Central Hunan	7,996.57	1,657.68	20.73
South Hunan	7,280.08	934.06	12.83
West Hunan	11,970.92	1,297.27	10.84

Note: Land area is based on aggregate figures for land area of each county provided in "Compilation of Hunan Province Forest Resources Data" compiled by the Hunan Provincial Department of Forestry.

(3) Varied Landforms, Mountainlands and Hills Predominating

Hunan has a complex geology. Throughout 81.65 percent of the area is found various kinds of sedimentary rock (including carbonitite in about 32 percent of the area plus sandstone, gravel, and shale) and metamorphic rock (such as slate, phyllite, and quartzite). Magmatic rock (such as granite) is found in 8.91 percent of the area. The interaction of external pressures over a long period of time has resulted in the formation of diverse landforms such as mountain plateaus, mountainlands, hills, uplands, and plains. Preliminary statistics on the classification of terrain features show mountains and hills accounting for 70.22 percent of the total area in the province, all other forms accounting for the 29.78 percent (including 12.54 percent for plains, and about 5.34 percent for water surfaces). The general composition of the land is roughly 70 percent mountainland, 5 percent water, 5 percent cultivated land, and 20 percent other than these. Clearly the province has a broad expanse of mountains and hills and an overly small plains area. (Table 3)

Table 3. Preliminary Statistics on Hunan's Geomorphology

(a) 类 型	(b) 标 高 (米)	(c) 比 高 (米)	(d) 面 积 (平方公里)	(e) 占全省面积 (%)	(f) 说 明
(g) 中 山	>800		52241	24.62	其中包括岩溶中山1.29% (n)
(h) 低 山	500—800	300—750	45922	21.70	其中包括岩溶低山6.24% (o)
(i) 丘 陵	<500	100—300	50639	23.90	其中包括岩溶丘陵9.98% (p)
(j) 岗 地		20—100	25141	11.90	
(k) 平 原		<20.	26557	12.54	其中包括岩溶平地5.31% (q)
(l) 河 湖 水 面			11300	5.34	
(m) 合 计			211800	100	

Key:

a. Type
b. Elevation (meters)
c. Specific elevation (meters)
d. Area (square kilometers)
e. Percent of total area (%)
f. Explanation
g. Mountains of medium height
h. Low mountains
i. Hills
j. Uplands
k. Plains
l. Rivers and lakes
m. Total
n. Including karst mountains of medium height, 1.29%
o. Including low karst mountains, 6.24%
p. Including karst hills, 9.98%
q. Including karst flat land, 5.31%

The action of water and heat on different features of the terrain and the material of which it is composed had a direct bearing on the formation and development of the soil and its suitability for the growth of plants. The red rock basins formed from chalk during the Tertiary Period and the alluvial river valley plains areas formed during the Quarternary Period are the province's principal agricultural areas. In the basins and in the surrounding hills and low mountains are thick deposits of red soil and yellowish red soil suitable for the growing of pine, fir, and mixed forests. In the red soil hill and upland areas, tea oil forests, which are photophilous and acid loving, are fairly concentrated, and these areas also favor the growing of tea and citrus fruits. At Huitong in the upper reaches of the Yuan Shui, at Shuangpai and Jianghua in the middle reaches of the Xiao Shui, and at Zixing and Ruicheng in the upper reaches of the Lai Shui, the sandy shale, slate, and phyllite has developed into mountainland yellow soil that is suited to the growth of fir trees making this one of the major Chinese fir growing areas south of the Chang Jiang. In the mountainlands along the Hunan-Jiangxi border, in Wuling, Xuefeng Shan and Hengshan, granite and epimetamorphic rock is found, and the layer of soil is thick and friable. Timber forests and tracts of moso bamboo proliferate here. In northwestern Hunan, carbonatite is found over a wide area, and calcium-loving plants are fairly abundant. This is the province's main tung tree growing area. Full

and equitable use of the natural resources of the vast mountain areas, increased organic linking of farming, forestry, and animal husbandry, and development of economic diversification are key aspects in the building of modern agriculture.

2. Critique of Regional Landforms

The entire province may be divided into seven landform areas on the basis of differences in the horizontal and vertical zones in the overall landform structure, and on the basis of the similarity of constituent forms and relative consistency in transformation for use of various types of landforms. (Figure 3)

(1) Dongting Hu Plains Region

This region is located in northern Hunan on the south bank of the middle reaches of the Chang Jiang and centering on Dongting Hu. It is a round dish-like basin formed of an alluvial and lacustrine plain, terraced land along the lake, and low hills encircling the lake.

In addition to Taohua Shan, Huangma Ling, Daqi Shan, and Taiyang Shan, which stick up like islands around the outer edges of the lake basin, the land is mostly low hills and rolling tablelands 150 meters above sea level, with a specific elevation of less than 100 meters, and with gentle slopes. The land is made up of epimetamorphic rock, sandy shale, and quartzite with some granite and a thick layer of Quarternary Period red soil. The terrace land around the lake has generally undergone successive transformations of erosion--main bottom--accumulation--and burial. The four outlets from Dongting Hu (of which Songzi, Taiping, and Ouchi remain, the Tiaoxian opening being stopped up), plus the deltas of the four rivers together form an alluvial and lacustrine plain that is crisscrossed by streams and dotted with cultivated fields.

Within this region, the land is lowlying and flat, most of it at an elevation of less than 50 meters above sea level and with a 6 degree gradient. The deltas of the four outlets from the lake are made up mostly of calcareous sandy purple fluviogenic mud. The sediment from the four rivers and their branches is composed mostly of sandy fluviogenic soil, and there is a substantial area of sandy fluviogenic mud as well, all of which are suitable for the growing of various kinds of crops. As a result of the large amounts of silt brought into the lake by rivers and enclosing of portions of the lake to make farmland, the lake's area has steadily shrunk; the bed of the lake has gradually risen over the years; and the lake's ability to impound water has weakened. Every year the threat of flooding or waterlogging exists in varying degrees. Passageways for the floodwaters must be built; dikes must be made higher and stronger; the lake must be controlled and fields upraised, and the drainage and irrigation system must be improved.

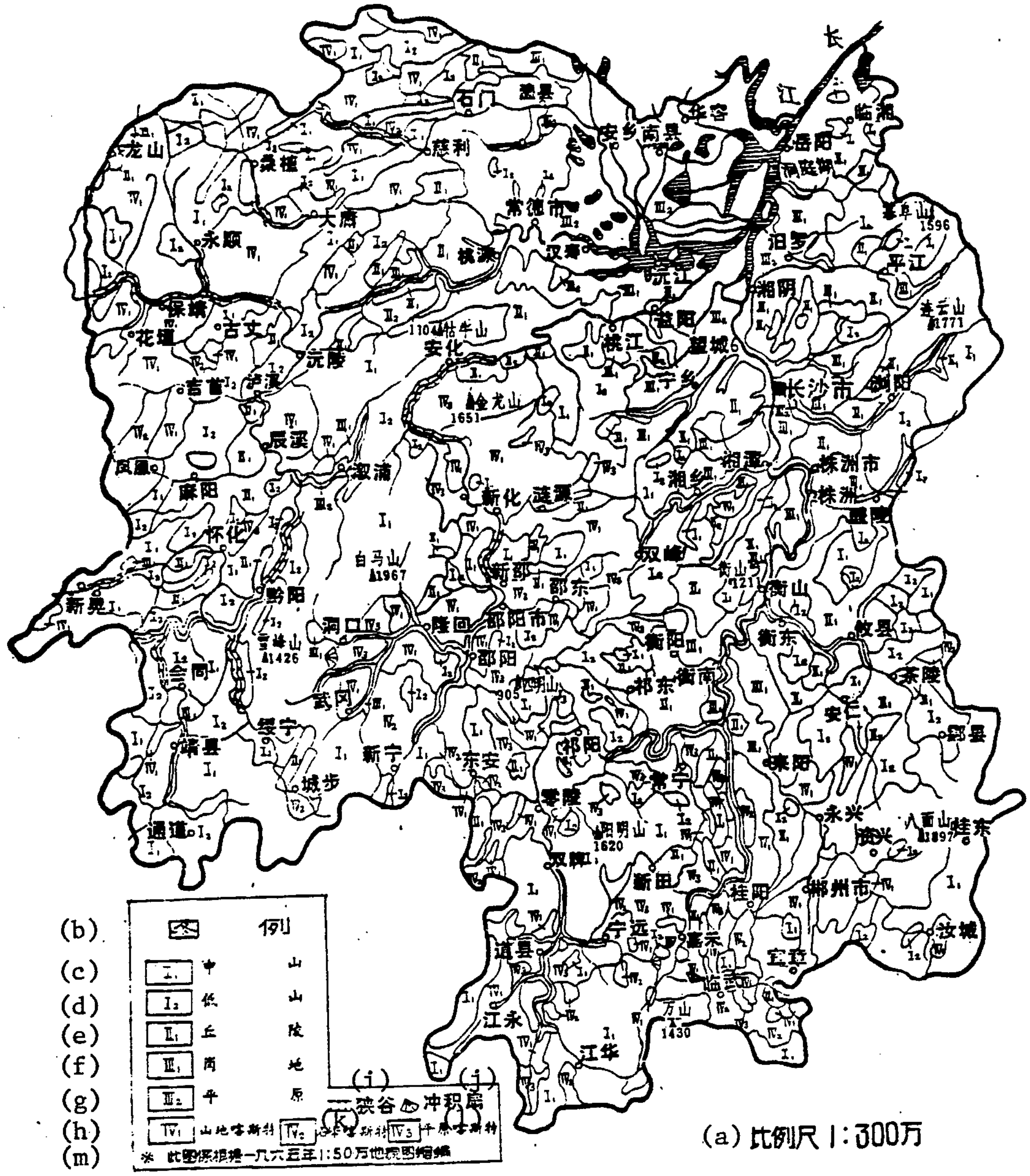


Figure 3. Map Showing Types of Landforms in Hunan Province

Key:

a. Scale 1:3,000,000
b. Legend
c. Medium high mountains
d. Low mountains
e. Hills
f. Uplands
g. Plains
h. Mountainland karst
i. Narrow valley
j. Alluvial fan
k. Rocky peak karst
l. Plains karst
m. * Map condensed from a 1965 topographical map at a scale of 1:500,000.

(2) The Changsha-Hengyang Hill and Basin Region

This region belongs mostly to the middle and lower reaches of the Xiang Jiang Basin and is an axis that runs through the province's concave inclined plain. It is characterized by the alternation of hills and broad valleys.

Red sandy shale, gravel, metamorphic rock, and granite are found here. At Heng Shan, Ziyun Shan, and on the east and south sides of the basin, some granitic mass protudes to form a mountain range. Red layer basins are widespread among the mountain ranges, some fairly large ones being the Changsha-Pingjiang Basin, the Liling-Youxian Basin, the Chaling-Yongxing Basin, the Xiang-xiang Basin, the Zhuzhou Basin, and the largest of them all, the Hengyang Basin. In general, the elevation of the basins gradually decreases toward their center. In the east monoclinal basins predominate, and the water systems of all the basins connect together and merge, the Xiang Jiang being the center of convergence. The Chunling Shui, Mi Shui, Lai Shui, and Zheng Shui converge in the section of the Xiang Jiang at Hengyang where they form a tree-shaped convergent water system. Terracing is well developed along the river, the land rising in seven levels. Major cities such as Hengyang, Zhuzhou, Xiangtan, and Changsha developed first on the terraced land along the river.

Agriculture developed fairly early in this area. Transportation is convenient; population is dense; intensivity of agriculture and the level of production are fairly high, and suburban agriculture has a long history. Transformation of the red hills and tablelands for use, and soil and water conservation are conspicuous problems. Simultaneous with development of agricultural production, vigorous efforts should be made to plant trees for afforestation and to improve the ecological environment.

(3) The Lianshao Hill and Valley Region

This region is located between the eastern foothills of the Xuefeng Shan and the Changsha-Hengyang Basin, and it is mostly a part of the Zi Shui basin. It is a transitional zone in which the basins of the Xiang and Zi rivers intermingle. Except for the craggy mountainland along the border, most of this region has hilly terrain, with short stretches of sandy shale and limestone on the spines of the hills. It presents a picture of undulating hills, ridges, and uplands. Elevation above sea level is between 100 and 500 meters, and between 600 and 700 meters in some places. A 1-3 grade plantation [0475 1138 7240] has developed that is crisscrossed by a water system shaped like the branches of a tree. River valleys of the main stream and of major tributaries are wide here and narrow there forming a partial basin-like topography. Basins such as the Xinhua-Lianyuan Basin, the Shaoyang-Longhui Basin, and the Lingling-Qiyang Basin to the south are major agricultural areas.

This region has a karst landscape of ridges and ravines, hills and lowlands, and mountainlands with clusters of peaks. Below ground, karst caves are fairly well developed. Most of the fields are wetlands, but there is a certain percentage of drylands as well. There are an appreciable number of

barren mountains and bald ranges suitable for development of water and soil conservation forests and the growing of timber forests.

(4) The Mufu-Lianyun Mountain and Hill Region

This region is located in northeastern Hunan Province and is the watershed area between the plains of the Dongting and Boyang lakes. The more than 1,000 meter high mountain peaks of granite and metamorphic rock gradually trail off westward into low mountains and hills of 800 to less than 500 meters in altitude. Going from north to south are Yuegu Shan, Mufu Shan, and Lianyun Shan as well as the Dawei Shan and Jiuling Shan complementary dikes, all of which run obliquely in a north by east direction like a wedge of flying wild geese. Mountain ranges alternate with valleys like the character "duo" [1122] tilted at a 45 degree angle to the right. This terrain both controls the direction of flow of the Xinqiang He, the Guluo Jiang, the Laodao He, and the Liuyang He, and helps strong southwestern air currents converge in the area. The region is prone to torrential summer rains, and during winter, temperatures are warmer in valleys on the south sides of the mountains than in the lake regions and in the valleys of the lower reaches of the Xiang Jiang.

This region formerly produced abundant forests, and it is still an important area for production of moso bamboo; however, other timber trees and broadleaf forests have been seriously damaged. Soil erosion is serious in the granite, and red sandy shale hill regions along the Xinjiang He, the Guluo Jiang, and in the upper reaches of the Laodao He. Vigorous efforts must be made to grow forests here and to do a good job of water and soil conservation work. Basins among the mountains are major agricultural areas.

(5) The Wuling Mountain and Hill Region

This region lies to the south of the Hengshao hill basin, and is the major part of the complex east-west tectonic area of the Nan Ling. Traveling from west to east in the Wuling Shan region, one encounters the Yuecheng Ling, Dupang Ling, Mengzhu Ling, Qitian Ling and Dayu Shan. To the north of the large area of rugged terrain along Hunan's borders with Guangxi and with Guangdong, as well as in the area where Hunan, Guangdong, and Jiangxi converge, Yangming Shan and Tashan act as a screen. Within Hunan, the mountain ranges are formed mostly of granite and metamorphic rock arranged in an interlocking pattern and extending in a somewhat east-west direction. Most main peaks are more than 1,500 meters above sea level and act as watersheds for the water systems north of the mountains, south of the mountains, and for the Chang Jiang as well as for the Zhu Jiang water system. However, some eroded tectonic valleys and relatively low strips of land between mountains are also crisscrossed by water systems, and are narrow corridors for the passage of air currents as well as for interprovincial intercourse.

Mountainlands within Hunan Province are at many levels, and low mountains and hills are also widely distributed. In areas such as Rucheng, Guidong, Lingxian, and Zixing in southeastern and eastern Hunan, mountains are fairly massive, but these areas also contain some basins such as the Yongxing Basin.

In the west are some basins among the mountains such as the Daoxian, Ningyuan, Jiangyong, Lanshan, and Jiahe basins. In limestone areas, both surface and underground karsting is very well developed, mostly forming shapes that look like mountain peak forests and valleys, and solitary peaks and valleys. There are numerous underground karst caverns and underground streams. Because of the interlocking of mountain ranges and basins, there are numerous types of topography. This region is located somewhat toward the south and has a mountain screen to the north, so it has a rather ample amount of heat. Moreover, vertical variations are fairly great and rainfall fairly abundant, more falling on the southeast and southern side of mountains than in central basins. Within the region are numerous mountains and forests, and fairly good conditions exist for the overwintering of semitropical fruit trees such as citrus. Quality of flue-cured tobacco and ramie produced here is rather good. The hills and basins are mostly used for farming.

(6) Xuefeng Medium and Low Mountain Region

This region occupies a fairly large area in the western half of the province and is mostly taken up with mountainlands. It is cut in the northwest by the narrow ribbon-like Yuanling-Mayang red mountain and hill basin where the Xihuang Shan and the Wuling Shan protrude, and where mountain ranges and valleys alternately rise and fall.

The Xuefeng mountain range is controlled by Neo-Cathysian and arcuate structures, the southern extremity assuming a north northeast direction, and the northern extremity being bent around in an east by north to northeast by east direction, interlocking in a series of folded and fractured structures. The mountain is composed mainly of metamorphic rock and its ancient rock formations, and towers in many ridges and peaks more than 1,500 meters high. The main peak, Subao summit on Luoweng Eight Sided Mountain, rises to 1,934.3 meters, and cuts across a vast expanse of 15 counties running for more than 300 kilometers. Its southern part has been powerfully uplifted and shows multi-level planation, the 800-900 meter planation rising to 1,200-1,800 meters. The eastern side descends in many stages and its slopes are craggy. This complex mountainland system not only forms a watershed between the Yuan Shui and the Zi Shui, but is also the dividing line between east and west in Hunan Province and between natural landscapes.

The broad mountainlands and the abundant forest resources in this area make the middle and upper reaches of the Yuan Shui a concentrated forest area. The valleys at the confluence of the Yuan Shui and its major branches are farming areas, and the Qianyang and Shufu hills and basins grow tangerines and pomelos.

(7) The Wuling Karst Mountain Plains Region

This region is located in northwestern Hunan on the left side of the Yuanshui Valley and mostly in the basin of the Li Shui. It has been intensively affected by the vast western Hubei-Guizhou Plain, and tilts upward from the northwest to the southeast. In the north are Badagong Shan and Huping Shan (at 2,099 meters above sea level), which tower over the Hunan-Hubei border.

Mountainlands in this region are well developed, with multi-level planations (1,200, 1,000, 800, 600, 450, and 350 meters) plunging southeastward. Tributaries on both sides of river valleys are asymmetrical. On the north shore are long streams that flow from a distant source, while on the south side the tributaries are short and swift. Along the Li Shui are large fracture areas, and the fault escarpments there are imposing and precipitous.

Karst topography is well developed in the region. Starta contain pure limestone, and the limestone contains small quantities of non-carbonate rock. Mostly the strata of limestone and dolomite containing small amounts of non-carbonate rock occur at different levels. As a result of long corrosion and erosion by water, a complex peak and valley topography, and hill and funnel lowland karst topography has been formed with fairly large numbers of underground caves and underground streams. Generally, third degree planation and karsting has developed everywhere. Streams are deep and course through narrow V-shaped valleys. The mountains stand upright with precipitous slopes, and the surface of plateaus are rugged and rough. As a result, cultivated land is dispersed over a wide area. Fields are high and water is low making water storage and irrigation difficult. As a result of natural conditions such as the terrain and geology, not only is this region suited to the growing of calcium-loving plants such as tung trees, Chinese tallow trees, Chinese chestnut trees, eucommia trees, and cypress, but now some mountain areas are keeping many kinds of relic plants and rare and valuable trees. Mostly corn is grown in mountain drylands, and there is also a certain area of grassland resources.

Second Section. Climatic Conditions

Hunan Province is located between 108°47' and 114°15' east longitude, and between 24°38' and 30°08' north latitude in the eastern part of the central sub-tropical belt. This is a transitional zone in which winter and summer monsoon winds and cold and warm air currents intermingle back and forth. Southeastern Hunan and Changsha in central Hunan are about 400 to 600 kilometers from the seacoast, and are screened by a horseshoe-shaped terrain that opens northward producing a continental environment. As a result of the influence of monsoon circulation and the complex terrain, both moisture and heat are unevenly distributed in time. Winter brings a short period of cold, while summers are long and hot. Spring is warm and very variable, while autumn winds produce a chill. Rainfall is concentrated, the early part of the year being wet and the latter part being dry, reflecting the fairly strong continentality of the climate. Overall, both water and heat resources are plentiful, and the growing seasons for major crops may be said to be well meshed, which helps the all-around development of farming, forestry, animal husbandry, sideline occupations, and fisheries.

1. Light Resources and Production Potential

The essence of agriculture is the photosynthesis of green plants, i.e., the use of sunlight by green plants to convert inorganic carbon dioxide and water into organic carbohydrates through the action of leaf chlorophyll and enzymes, thereby producing farm products. Thus, solar radiation is the source of radiation whereby farm crops carry on photosynthesis to produce output.

1. Number of Hours of Sunshine: In most years, Hunan Province averages between 1,300 and 1,800 hours of sunshine annually (Figure 4). The Dongting Hu region and nearby hills and basins get the most, Yueyang receiving as much as 1,840 hours, and Changde, Pingjiang, and Changsha getting more than 1,700 hours each year. Lingling and Chenzhou in southern Hunan also receive more than 1,600 hours. Anhua in the Xuefeng mountain region and Tongdao in southwestern Hunan receive about 1,400 hours of sunshine annually, while Jianghua in the Mengzhu Ling mountain region receives only 1,360 hours. Clearly, the amount of sunshine a place receives is determined not only by geographical latitude but is also influenced to a very great extent by topography and the amount of cloud cover. Hunan Province is one of the regions in the country with a fairly large amount of cloud cover, more in mountain regions than in hills and basins. The overall number of hours of sunshine in the province is lower than for many parts of the country. Year to year variation in the number of hours of sunshine is fairly great. Changsha, for example, received 2,124 hours in its maximum year (1956) and 1,409 hours in its minimum year (1970), a difference of 715 hours. A similar situation prevails elsewhere. The annual sunshine percentage rate (actual number of hours of sunshine as a percentage of actual possible number of hours of sunshine) runs generally between 30 and 40 percent, and may amount to more than 40 percent in lake regions. During the course of a year, both the number of hours of sunshine and the sunshine percentage rate vary from place to place and from season to season. During July and August, there are more than 200 hours of sunshine, and the sunshine rate is greater

than 50 percent. During March and April, there are only 80 to 100 hours of sunshine; in lake regions the sunshine rate is 30 percent, and about 25 percent elsewhere. Autumn is second only to summer in the amount of sunshine, which is greater than in winter and spring. The foregoing shows light and heat conditions well matched in Hunan Province during July and August, which makes for high yields of crops that are harvested in the fall, while the scant sunshine during the reproductive and growth stages of overwintering crops is bad for the formation of firm grain and impairs output.

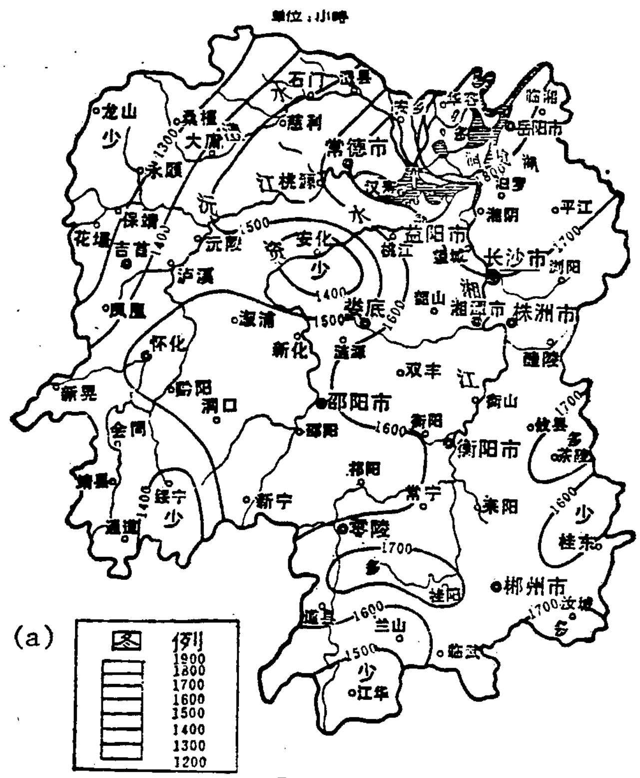


Figure 4. Map Showing Average Daily Hours of Sunshine

Key:
 a. Legend

2. Solar Radiation: Except for Changsha, solar radiation measurement data are not available for most areas of the province. Preliminary calculations show an annual solar radiation of between 92 and 114 kilocalories per square centimeter, which is slightly above average for the country. Within the province, the southeast tends to get more and the northwest less solar radiation. The 105 kilocalories per square centimeter per year isopleth roughly follows a line through the eastern foothills of the mountain regions of Wuling, Xuefeng, Yuechen, and Dupang dividing the province into eastern and western parts. In the eastern section, solar radiation amounts to 105 kilocalories per square centimeter per year, with places like Yizhang, Xintian, Rucheng, Chaling, and Yueyang receiving more than 110 kilocalories per square centimeter per year. The western area gets less than 105

kilocalories per square centimeter per year, with places like Anhua, Longshan, Huayuan, and Jishou receiving less than 95 kilocalories per square centimeter per year.

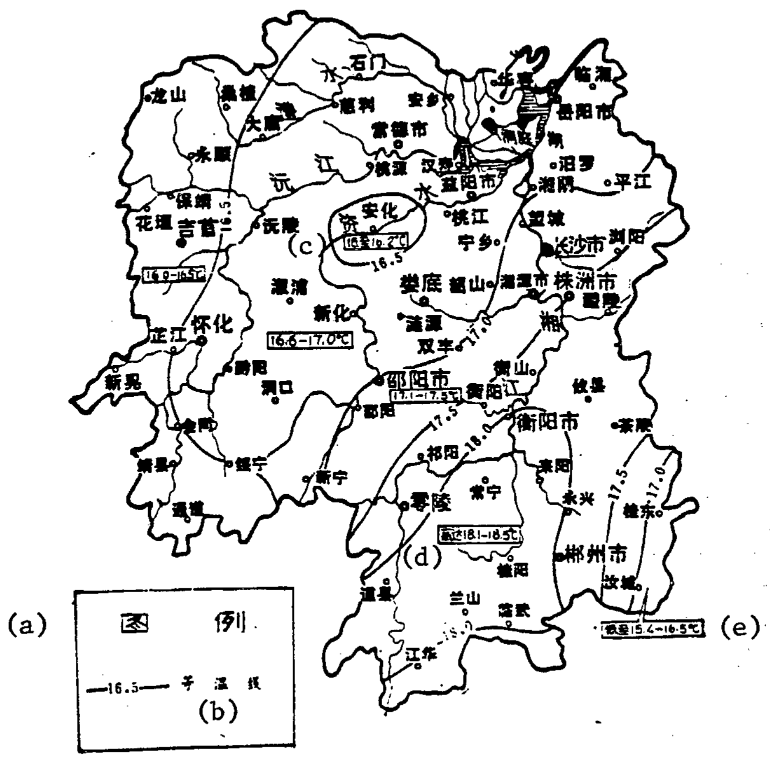
There are seasonal variations in total radiation. In winter, total solar radiation is between 14 and 17 kilocalories per square centimeter, which is only 15 percent of the total for the year. In spring, it is between 25 and 27 kilocalories per square centimeter, or about 24 percent of the annual total. In summer, most places get more than 40 kilocalories per square centimeter or 37 percent of the annual total. During autumn, it is around 25 kilocalories per square centimeter, or 24 percent of the total for the year. These changes are basically synonymous with the pattern for number of hours of sunshine daily and temperature during the four seasons throughout the province.

The visible light from solar radiation that plants absorb and use directly is termed effective photosynthesis radiation (or physiological radiation), which accounts for half the total radiation. In Hunan Province, the average annual effective photosynthesis radiation value is 46-57 kilocalories per square centimeter, the higher figure applying to the lake regions and to the hills and basins of central Hunan, and the lower figure applying to western Hunan and other regions. April to September is the time of year when effective photosynthesis radiation is higher than at other times, and this is the time when major farm crops grow, develop, and form seeds. Because of the effects of temperature, gaps between crop seasons, and factors during the initial period of growth, not all solar radiation light energy can be used. If general methods could be suited to specific situations in a reform of the farming systems to arrange matters so that grain would form between May and August, this would rather fully use this segment of light energy resources. Converted to grain output, this would mean yields of at least 3,800 to 4,000 jin per mu. In 1979, grain crop yields averaged 1,011 jin per mu of cultivated land, the yield roughly amounting to a 2.5 percent light energy utilization rate. This is a long way from the 5 percent light energy utilization rate that is attainable over wide areas. Consequently a considerable potential exists for making full use of light energy resources to boost grain yields per unit of area to the maximum in Hunan Province.

2. Heat Conditions and Agricultural Production

Temperatures average 16-18°C in Hunan Province in most years, the average temperature in southern Hunan being about 2°C higher than in northern Hunan and about 1°C higher in eastern Hunan than in western Hunan. Temperatures on plains and in valleys run 1-2°C higher than in mountains and hills. January temperature averages 4-7°C, with a difference of about 3°C between north and south. The average temperature in July is 27-30°C, a 3.5°C difference between east and west. The annual variation for all parts of the province is between 19 and 25°C, the variation being greater in the north than in the south and greater in the east than in the west (Figure 5). In terms of the temperature limits for safe growth of most crops and the special agricultural climate requirements of major crops such as grain and cotton, southern Hunan has between 300 and 320 days when sustained average

daily temperature is higher than 5°C (for the growing of overwintering crops such as winter wheat, the sprouting of rape, or slow growth). Generally this period begins during the second 10 days of January. Other areas have between 280 and 300 days, usually beginning during the last 10 days of February. Southern Hunan has 250-260 days when temperatures remain above 10°C (for vigorous crop growth), and other places have 240-250 days, usually beginning during the last 10 days of March and continuing till the first 10 days of November for a period of about 8 months. Active cumulative temperatures of 5,000-5,700°C are fairly common in the vicinity of Hengyang and Xintian and less common in places like Anhua in western Hunan (Figure 6). There are 190-200 days when temperatures remain above 15°C (required for rapid growth of heat loving crops like paddy rice and cotton.) Northern and northwestern Hunan have between 160 and 180 such days, usually beginning toward the end of April and ending in mid to late October during which cumulative temperatures reach between 3,900 and 4,900°C (with 80 percent certainty). Days when temperatures are higher than 20°C (of particular importance to safe heading of late crop rice) average 120 to 150. Usually such temperatures begin in mid May and last until mid to late September. The average frost-free period is 270 days for northern Hunan and about 310 days for southern Hunan. For western Hunan and other fairly high mountain regions, it is somewhat more than 250 days (Table 4 and Figure 7). Clearly Hunan Province has abundant heat and its growing season is long. Most places have sufficient heat to meet requirements for growing two crops of rice plus five catch crops every 2 years as well as citrus, tea, tung, and moso bamboo.



Key:
- a. Legend
- b. Isopleth
- c. As low as 16.2°C
- d. As high as 18.1-18.5°C
- e. As low as 15.4-16.5°C

Figure 5. Map Showing Average Annual Temperature

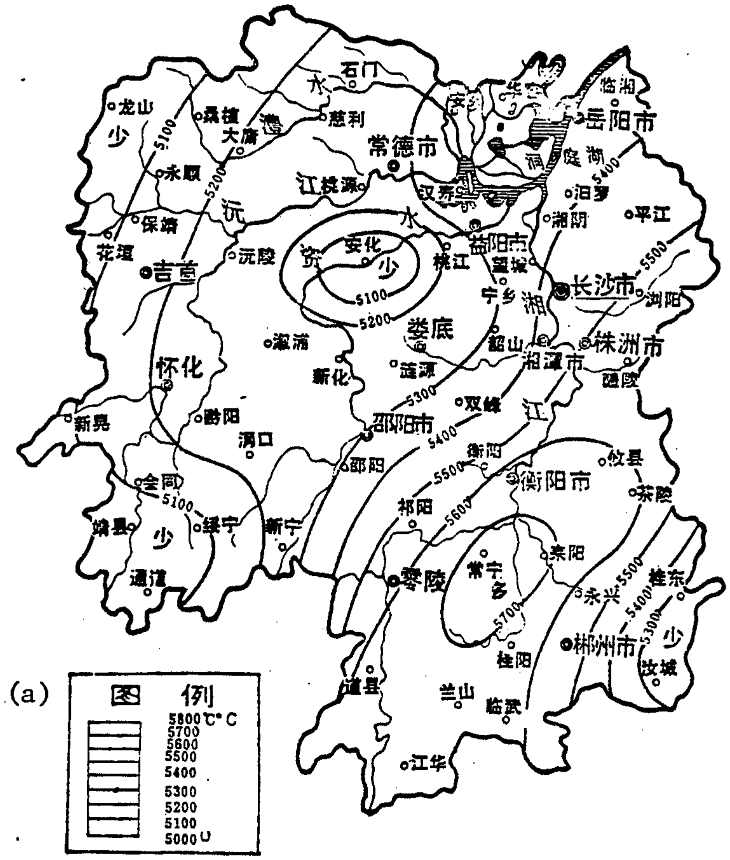


Figure 6. Map Showing Cumulative Temperatures When Average Daily Temperature Is Equal To or Greater Than 10°C

Key:

a. Legend

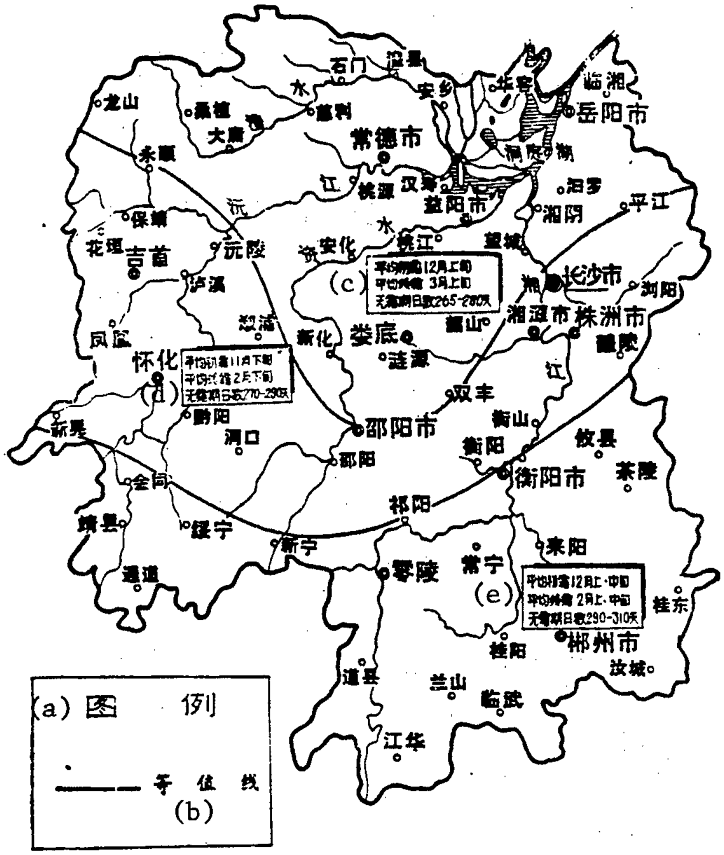


Figure 7. Map Showing Frost-Free Periods

Key:

a. Legend
b. Isopleth
c. Average time of first frost is first 10 days of December
   Average time of end of frost is first 10 days of March
   Number of frost-free days is 265-280
d. Average time of first frost is last 10 days of November
   Average time of end of frost is last 10 days of February
   Number of frost-free days is 270-290
e. Average time of first frost is early to mid December
   Average end of frost is early to mid February
   Number of frost-free days is 290-310

Table 4. Four Seasons and Length of Growing Season (Number of Days) in Various Places in Hunan Province 1951-1974

(a) 地名	(g) 春	(h) 夏	(i) 秋	(j) 冬	(k) 日平均气温等于和大于				等于和大于10℃的活动积温 (l) (℃)	(m) 无霜期
					5℃	10℃	15℃	20℃		
(b) 岳阳	70	130	60	105	285	239	183	138	5336.6	274
(c) 长沙	70	130	60	105	289	242	187	140	5456.3	277
(d) 郴州	75	135	60	95	297	242	193	145	5557.2	300
(e) 芷江	70	130	55	110	291	240	180	129	5172.7	279
(f) 龙山	75	105	70	115	296	243	186	116	5013.3	277

Key:

a. Place
b. Yueyang
c. Changsha
d. Chenzhou
e. Zhijiang
f. Longshan
g. Spring
h. Summer
i. Autumn
j. Winter
k. Average daily temperature equal to or greater than:
l. Active cumulative temperature equal to or greater than 10°C
m. Frost-free period

Heat conditions in Hunan Province greatly benefit agricultural production while having the following detrimental effects at the same time.

I. Cold Damp Springs

During the second 10 days in March, temperatures everywhere throughout Hunan Province average more than 11°C, and during the last 10 days of March they are above 12°C. During the first 10 days of April they climb everywhere to more than 14°C. This is beneficial to the sowing and propagation of early rice. However, the period from March to May is a transitional one in which cold and warm air currents alternate. Cold waves are frequent; there are numerous changes between cold and hot, and low temperature, rainy and overcast days are numerous. Cold air movements over the years have occurred on an average of three or four times each month during March and April, which is to say about once every 7 to 10 days, and two to three times each month during May. If figured on the basis of an average daily temperature of less than 10°C for each cold wave, then there are 2.9 to 3.3 occurrences everywhere during March and between 0.7 and 1.0 occurrences during April. There is a gradual decline in frequency from north to south with a slightly greater frequency only at Zhijiang in southwestern Hunan during March. (Table 5)

Inasmuch as cold wave activity varies in intensity from one year to another, there are very great changes from year to year in temperatures during each 10-day period everywhere in the province, and a difference of about 100 percent between high and low during the same period. Furthermore, the lowest temperature is frequently greater than the extreme value that occurs during

the shift to fair weather after the cold wave passes. During the first 5 days of March, temperatures of below 0°C occur everywhere, and during the last 10 days of March and the first 10 days of April, temperatures below 3°C occur everywhere. During the second 10 days of April, sometimes temperatures are around 5°C, and during the last 10 days of April, temperatures still have an extreme value of about 7°C. This shows that temperatures climb slowly and are unstable during this period (see Table 6).

Table 5. Number of Times Average Daily Temperatures of Less Than 10°C Occur During March and April Cold Waves in Hunan Province

	地(a)点	岳(b)阳	长(c)沙	郴(d)州	沅(e)陵	芷(f)江
(g)	三 月	3.2	3.1	2.9	3.0	3.3
(h)	四 月	1.0	0.1	0.7	0.8	0.8

Key:
a. Place
b. Yueyang
c. Changsha
d. Chenzhou
e. Yuanling
f. Zhijiang
g. March
h. April

Table 6. Minimum Temperatures (°C) at Various Places in Hunan Province During March and April

	(a) 三 月			(b) 四 月		
	上 (c) 旬	中 (d) 旬	下 (e) 旬	上 (c) 旬	中 (d) 旬	下 (e) 旬
(f) 岳 阳	-1.7	-3.8	1.4	0.8	5.4	6.9
(g) 长 沙	-1.6	-2.3	2.9	2.5	5.0	6.4
(h) 郴 州	-2.7	-0.5	0.6	1.3	4.7	6.2
(i) 沅 陵	-1.4	-0.9	1.5	1.2	5.1	7.1
(j) 芷 江	-1.7	-0.8	1.9	2.1	5.0	9.3

Key:
a. March
b. April
c. First 10 days
d. Second 10 days
e. Third 10 days
f. Yueyang
g. Changsha
h. Chenzhou
i. Yuanling
j. Zhijiang

Each cold wave and drop in temperature is usually accompanied by continuously overcast and rainy weather lasting from 3 to 5 days and sometimes for as long as 10 to 15 days. That is to say that more than half the days in March and April are overcast and rainy. As a result, the number of hours of sunshine are relatively scarce. Except for Yueyang in northern Hunan with a

31 percent sunshiny day rate in April, every place else has less than 30 percent, particularly during March when it is generally less than 25 percent. When the cold air currents hit northern Hunan, there are a fairly large number of cold waves, but once the cold currents have stopped, the weather becomes stable. In central Hunan, cold air currents have a substantial influence and are also very strong. By the time the cold air currents invade southern Hunan, their force has been largely spent; but they are affected by warm air from the south and by the mountainlands, now intruding, now receding, rising and falling. This change is particularly noticeable in the area around Chenzhou. However, Xintian, Yizhang, and Liwu on the south side of Yangming Shan and Qitian Ling are relatively little affected by the cold waves.

The low temperatures and rainy overcast weather that occurs in the province at the end of March, in early and mid-April, and in early May are very unfavorable for the sowing of early rice and the propagation of seedlings, as well as for differentiation of young panicles. They also hurt the sowing of cotton, and the booting of wheat. Early rice is strongly temperature sensitive, requiring temperatures above 10°C during the period of growth and development of seedlings. At a temperature around 12°C, growth is slow, but at a temperature above 15°C, growth is normal. When average daily temperature is lower than 10°C and overcast and rainy weather lasts for more than 3 days, rotting of seeds and seedlings becomes a possibility. If daily temperature averages less than 14°C, transplanting of seedlings into open fields can also be affected. The average period when temperature in Hunan Province stabilizes at 10°C (i.e., an arbitrary 5-day average temperature) comes fairly early in southern Hunan usually around 22 March. In northern Hunan, it comes somewhat late, usually around 26 March. In other places, it occurs between the two dates, tending to advance from south to north. The date that can be guaranteed with better than 75 percent certainty is 27 or 28 March in most places, with the exception of northern Hunan where it is 4 April. Thereafter, the period when average daily temperature will be lower than 10°C is virtually sure to be no more than 3 days. Furthermore, following each cold wave there is usually a "return of warmth period," which usually occurs each year after 18 and 26 March. Probability is fairly great that a warm period will occur between the end of March and around Qingming [circa 5 April]. Consequently, generally speaking, plans for most sowing are set for the period after the vernal equinox (i.e., during the latter part of March) when the time is ideal after the cold currents have passed. It is necessary to act on the basis of weather forecasts and the geography to grasp the "tail of the cold and the head of the warm" weather to sow on time and to propagate seedlings carefully. Mid to late May is the time of vigorous tillering of intermediate to late maturing early rice, and early maturing varieties also begin differentiation of young panicles. In some years, average daily temperatures of 20° or below 15°C occur causing extremely slow tillering of seedlings. This produces serious black root and seedling death, and increase in the empty glume rate hurts output. For this reason, it is necessary to match varieties, plant sparsely for sturdy seedlings, transplant sufficient basic seedlings, and intensify fertilization and watering.

II. Autumn Season Cold Dew Winds

As a result of the gradual southward movement of the interface between polar region air masses and temperate zone air masses in autumn, around the time of the autumn equinox in mid to late September fairly strong cold air frequently invades the province and average daily temperature may plunge to below 20°C to the accompaniment of sustained overcast and rainy weather. The masses term this the "autumnal equinox storm" or the "mass wind," which is now generally termed the cold dew winds. This is precisely the time when double crop late rice heads and flowers. When it encounters such cold weather, it undergoes physiological functional deterioration causing an increase in the empty glume rate or even inability to head, which leads to a fall in yields.

The average time of onset of average daily temperatures below 20°C in Hunan Province is between 17 September and 2 October, low temperatures occurring earliest in the province's northwestern prefectures, particularly in Huayuan County, and latest in prefectures to the south of Hengyang. The earliest dates of occurrence are 3 September in western Hunan and 10 or 11 September in eastern Hunan; however, in most areas low temperatures begin around 11 September. Thus, there is no great difference between one place and another, but there is a substantial difference between one place and another in the annual probability of occurrence and in duration. In places to the south of Chaling and Hengyang, cold dew winds occur on an average of three or four times every 10 years; in central Hunan and the lake region, as well as at Zhijiang and Yuanling in western Hunan, they occur on an average of five or six times every 10 years; and in northwestern Hunan they occur seven or eight times every 10 years. In general, cold dew winds are not likely to occur before 10 September. Except for Changsha and Chaling, where some uncertainty exists, the likelihood that cold dew winds will occur elsewhere between 10 and 15 September is between 4.2 and 21.1 percent. For the period 15 to 20 September, the likelihood is 4.2 to 29.4 percent. The likelihood of occurrence between 20 and 25 September is 4.2 to 28.6 percent; and the likelihood of occurrence between 25 and 30 September is 12.5 to 41.2 percent. As time passes, the probability of occurrence gradually increases. In some years, after low temperatures occur during the last 10 days of September, they continue or climb only slowly in early October, and the threat that the late rice crop will not mature becomes increasingly serious. Usually cold dew winds last for 3 to 4 days, or 8 to 11 days at most. During this period, average temperature in most years is around 17 to 18°C. In lowest years, they may fall to around 16°C everywhere, and in extremely low years, they may even fall to around 12-15°C. In addition, comparison of meteorological data for September from Guidong, Nanyue and Huayuan with data from nearby Chenzhou, Hengshan and Yuanling shows temperatures to fall by from 0.53-0.62°C for every 100 meter rise in elevation. The onset of sustained average daily temperatures lower than 20°C must be advanced by 1.6 to 3.5 days, and the period of crop growth and development must be reduced by an average 1-2 days.

Because of the threat that cold dew winds pose to the late rice crop, the heading period is a crucial one. If temperatures during this period are

above 20°C, the damage is slight. Therefore, strict control over continuous cropping of late rice to assure an 80 percent probability of safe heading is imperative, using knowledge of the times when cold dew winds strike and the changes in air temperatures at different strata in individual areas. The safe heading period for places to the south of Chaling and Hengyang is before 25 September; for most places in the vicinity of Changsha, Shaoyang, Yueyang, and Changde, it is before 20 September; and in western Hunan and mountain regions, it is before 15 September.

The province's current promotion of the growing of hybrid rice has resulted in remarkable increases in yields. Hybrid rice is temperature sensitive, and high temperatures and strong sunlight are important conditions for getting the most out of hybrid rice. However, both low temperatures and high temperatures impair heading. If temperature conditions are not favorable, large numbers of empty glumes and decline in yields may result. Hybrid rice requires a long growing season, and in Hunan Province the total growing season for intermediate rice is between 135-140 days. For the growing of double crop late rice, the full growing season is around 125-130 days. It is extremely important to set a safe full heading period and a suitable sowing period in order to get bumper harvests. Research shows that when average daily temperatures are greater than 30°C for 11 out of any 15 consecutive days during the hottest days of summer, damage occurs to intermediate hybrid rice during its booting stage. At Changsha, the period of high temperature damage begins on 6 July and ends on 16 August (an 80 percent certainty rate). Ten days after the onset of high temperature and the final day are termed two safe full heading periods for intermediate hybrid rice. In order for full heading to take place before 16 July, the rice must be sown in late March or early April with transplanting of seedlings taking place at the end of April or early May. For heading to begin after 16 August, sowing must be done after 20 May, with transplanting of seedlings taking place during the last 10 days of June in order to avoid damage from high temperatures during the period between mid-July and mid-August. In addition, more than 4 days of continuous average temperatures of less than 23°C during autumn will hurt heading and flowering of late crop hybrid rice. The beginning of the low temperature period is 10 September (an 80 percent rate of certainty), so the safe full heading period for late rice is before 10-15 September. This requires sowing before 10-15 June and transplanting of seedlings before 20-25 July. Hybrid rice poses fairly strict nutritional demands, and early sowing and transplanting is an important measure for gaining high yields of late rice. In mountain regions, it is even more important to advance the planting time for intermediate rice.

3. Precipitation and Its Effects

As a result of its latitude and its continental position relative to the sea, Hunan Province is under control of atmospheric circulation and diverse weather systems, the influence of East Asian monsoon circulation being most apparent. In addition, the complexity and diversity of mountain and river topography and types of landforms cause striking differences and cyclical changes in the distribution of precipitation in space and time.

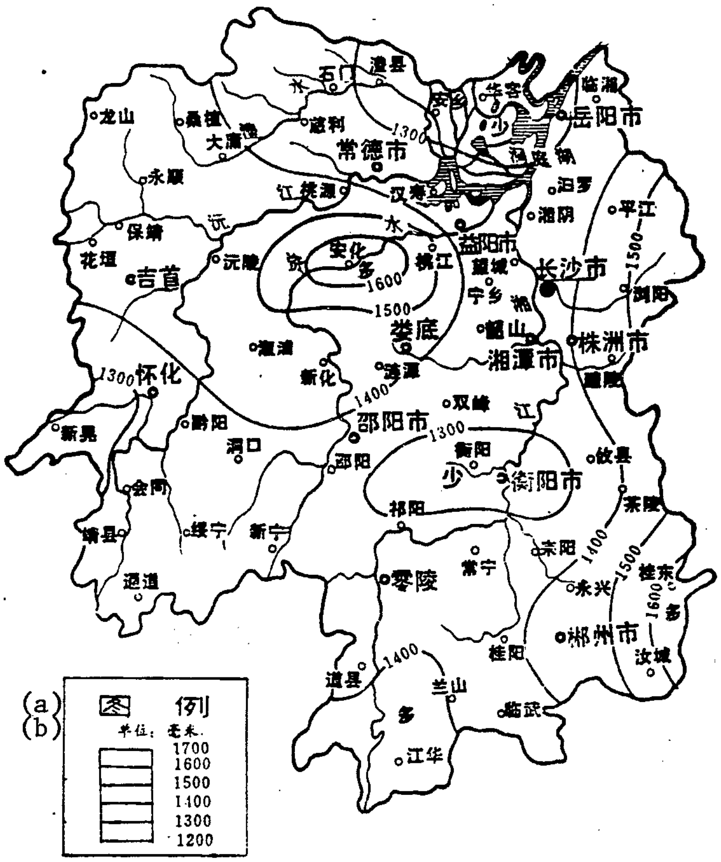


Figure 8. Map Showing Annual Average Distribution of Precipitation

Key:

a. Legend
b. Units: millimeters

In most years, precipitation averages between 1,200 and 1,700 millimeters in Hunan Province, making it one of the places of greatest rainfall in the country. Precipitation during the main growing season (April to September) is 600 to 1,000 millimeters (an 80 percent frequency value). (Figure 8) This generally satisfies crop needs for water; however, distribution of rainfall in the course of the year is uneven, and dry and wet seasons are pronounced. The frequent intermingling of cold and warm air currents toward the end of spring and the beginning of summer gives rise to protracted rainy and overcast weather and the beginning of the rainy season. Except for northwestern Hunan and the mountainlands of southern Hunan, which receive a substantial amount of rainfall during June and July, all other areas get their greatest rainfall during May. Half of the annual precipitation falls between May and July in western Hunan, and between April and June elsewhere in the province. As a result of the stability of sub-tropical high pressure, clear, rainless weather occurs between July and September. The periods of most rainfall between May and September occur during the last 10 days of May, during mid-June and July, and during the last 10 days of August. The

periods of little rainfall generally occur during the first and last 10 days of June, during early July and August (in mid-August in western Hunan), and during the first 10 days of September. After October the autumn winds and autumn rains arrive and the amount of precipitation increases somewhat.

I. Occurrence of Waterlogging and Drought

Hunan Province receives copious rainfall, but its seasonal distribution is uneven. During the 3-month period April-June, more than 40 percent of the total annual amount of precipitation falls. As a result of the complex weather systems prevailing between May and July, and the intermingling and clashing of cold and warm air currents at this time, heavy showers of fairly great intensity occur. Between 60 and 80 percent of the number of days of torrential rains each year occur at this time, and mountain torrents and waterlogging are likely to occur. In years of large amounts of rainfall, in particular, when the four rivers converge in torrents on the lakes and the flood discharge of the Chang Jiang forms a reverse siphon, agricultural production in lake regions is seriously threatened. Frequently an urgent need for flood and high water prevention arises. After June, however, subtropical high pressure gradually comes to dominate the province, and temperatures continue to climb. The number of hours of sunshine increases, and the amount of transpiration rises. At this time when crops are growing most vigorously and their need for water is greatest, the amount of precipitation diminishes rapidly. From July to September, the weather is clear and hot; south winds (hot dry winds) blow strong; transpiration is strong; and total rainfall amounts to only between 237.0 and 444.7 millimeters, which is only 17.1-30.8 percent of total annual rainfall. In years of scant rainfall, the amount is only 47.8-166.1 millimeters, which is only 15.7-47.0 percent of the amount of precipitation for the same period in most years, or between 4.3 and 13.9 percent of annual precipitation for the year (Table 7 and Figure 9). However, it is during this period that the late rice crop consumes 497.5 millimeters of water between the time of transplanting until the milk ripe stage. This is an average consumption of more than 6 millimeters per day. This means that in years of normal precipitation, inflow is less than outflow. July and August, the time when crops require large amounts of water, is precisely the time when the greatest drought occurs. This incongruity between water and heat conditions is a major reason for low and inconsistent yields in agricultural production.

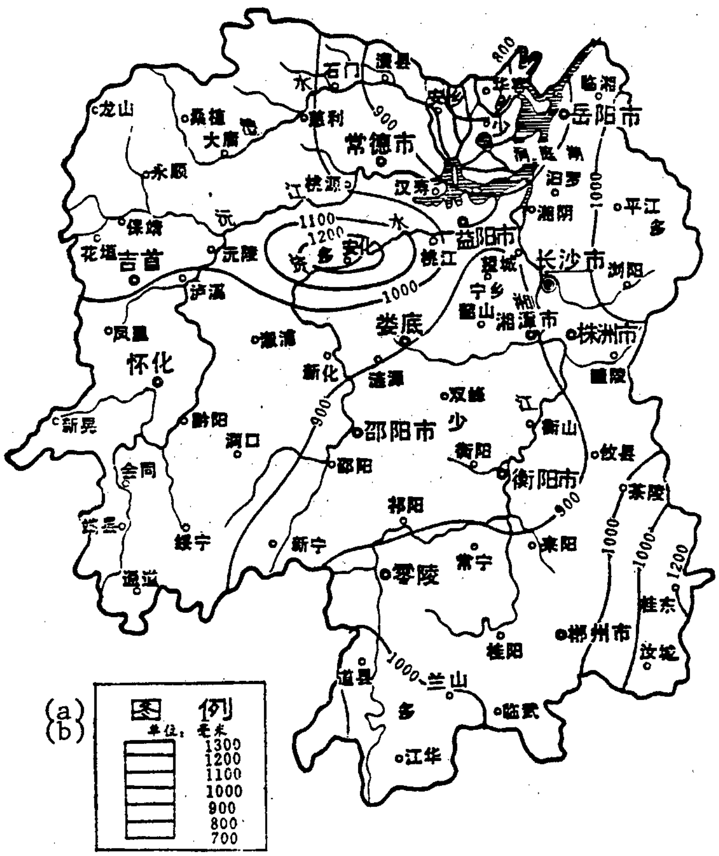


Figure 9. Map Showing Rainfall Distribution, June-September

Key:
- a. Legend
- b. Units: millimeters

Table 7. Precipitation in Various Places in Hunan Province, July-September (Units: millimeters)

(a) 流域 / (g) 站名 / 项目 (r)	(b) 湖区		(c) 湘江流域			(d) 资水流域		(e) 沅水流域		(f) 澧水流域
	(h) 岳阳	(i) 常德	(j) 长沙	(k) 衡阳	(l) 郴州	(m) 邵阳	(n) 安化	(o) 沅陵	(p) 芷江	(q) 大庸
(s) 7—9月的降水量	255.8	363.5	293.4	237	325.6	278.8	444.7	404.5	338.4	427.2
(t) 7—9月的降水量占年降水的%	17.1	26.5	20.8	17.6	22.1	20.8	26.4	26.9	27.0	30.8
(u) 7—9月降水最小值	47.8	57.1	101.8	85.4	107.9	93.9	163.9	166.1	159.0	139.7
(v) 7—9月降水最小值占同年降水的%	4.3	5.4	7.6	6.2	10.5	10.2	11.4	11.8	13.9	9.6
(w) 7—9月降水最小值占历年同期降水%	18.4	15.7	34.7	36.0	33.1	33.7	36.9	41.1	47.0	32.9

Key:

a. Drainage area
b. Lake region
c. Xiang Jiang basin
d. Zi Shui basin
e. Yuan Shui basin
f. Li Shui basin
g. Station name
h. Yueyang
i. Changde
j. Changsha
k. Hengyang
l. Chenzhou
m. Shaoyang
n. Anbei
o. Yuanling
p. Zhijiang
q. Dayong
r. Particulars
s. Precipitation July-September
t. July-September precipitation as a percent of annual precipitation
u. July-September precipitation minimum value
v. July-September precipitation minimum value as a percent of annual precipitation
w. July-September precipitation minimum value a percent of precipitation during the same period in most years

II. Seasonal Patterns of Drought and Waterlogging

The masses have the following to say about the patterns of drought and waterlogging: "Drought and waterlogging occur in Hunan year after year and every year; much rain falls during spring and summer, but mid-autumn is dry. Drought covers whole areas, but waterlogging follows lines." Analysis of statistics shows the existence during this century (1900-1975) of a definite cycle in the occurrence of drought and waterlogging in Hunan Province. Flooding and waterlogging has a regular cycle of once every 5, 14, 18, and 20 years, and drought usually occurs on an average of once every 14 years in a major cycle and once every 7 years in a regular cycle. Since liberation, there has been a drought once every 2 or 3 years, and a continuous drought about once every 6 years. In extent of occurrence, regular droughts and waterloggings have been numerous, but particularly severe droughts and waterloggings have been few. The particularly severe flooding and logging of 1906, 1931, and 1954, for example, occurred in only 10 percent of

waterlogging years for about one occurrence every 24 years or so. Regular waterlogging occurred in 90 percent of the years. Likewise, particularly severe provincewide drought years have been extremely few. For 25 years following liberation, particularly severe drought occurred only in 1960, 1963, 1966, and 1972. Most drought years were ordinary ones. Distribution in time and space was marked by a proneness to waterlogging in spring and summer and a proneness to drought in mid-autumn. Waterlogging occurred along specific stretches, with more waterlogging in the north than the south. Drought occurred over various areas, with more in the south than the north. From mid-April to early May, the period of possible waterlogging moves from the south northward, and the last 10 days of June is a major period for both drought and waterlogging in the province. The second major periods are the end of May and the end of July. During these times, torrential rains fall in many places opening the way to a strong likelihood of mountain torrents developing that converge in rivers and lakes to cause floods. Over the years, flooding and waterlogging has been most frequent in western Hunan, particularly around Sangzhi, Yuanling, and Anhua. The second most frequent area of occurrence has been the Dongting Hu area in northern Hunan, while frequency of flooding and waterlogging in southern Hunan and central Hunan has been relatively slight. However, in late August, both southern and southwestern Hunan are affected by typhoons and east wind weather systems, and each area goes through a period of proneness to waterlogging. Since most flooding and waterlogging occurs on both banks of rivers, it is characteristically "waterlogging along a line." From early and mid-July until early August, the period of proneness to waterlogging comes to a close from south to north, and all places enter the mid-autumn period of scant rainfall and drought. This results from intensification and westward extension of sub-tropical high pressure and coincides with the conclusion of the rainy season in the province. Except for northern Hunan, two main drought periods occur in the province. These are the dog days droughts that begin at the end of June or in early July and go on till early August, and the fall drought that begins at the end of August or early September and goes on till the end of October. Droughts of these two kinds have taken place in 48 places in the first 25 years after liberation. Summer drought and protracted mid-autumn drought are relatively rare. Each account for one-third of the first two kinds. Continuous summer and autumn drought has occurred in 2 years in some places. One may suppose that mid-autumn drought is a climatic phenomenon of Hunan Province, or that it is provincewide in scope, or that it occurs over most areas, or that it is occasional. It occurs every year; only its duration and degree vary. Drought areas happen to be just the reverse of flood and waterlogging areas. In the first 25 years after liberation, droughts were most frequent in southern Hunan, second most frequent in central Hunan, and least frequent in southwestern Hunan. If the number of times mid-autumn continuous droughts have occurred are added in and comparisons made, then the Hengyang Basin in central Hunan becomes the area in which droughts are most likely to occur and to be most serious. Lianshao Prefecture, in particular, has had a substantial number of mid-autumn droughts. Though fewer have occurred in northwestern Hunan, facilities for impounding water are poor there so droughts can easily occur. Conversely, somewhat more droughts have occurred in northern Hunan than in northwestern Hunan, but since sources of water are plentiful and irrigation readily carried out, the effects of droughts have generally not been serious. (Table 8)

Table 8. Statistical Table Showing Frequency of Summer and Autumn Droughts in Various Places in Hunan Province

(a) 次数 / (h) 干旱性质	(b) 湘西北	(c) 湘西南	(d) 湘北	(e) 湘中	(f) 湘南	(g) 合计
(i) 夏旱	2	2	4	3	5	16
(j) 伏旱	9	6	4	7	12	48
(k) 伏秋连旱	2	3	3	5	2	15
(l) 秋旱	7	10	12	13	13	45
(m) 夏秋连旱	1	1	0	0	0	2
(n) 合计频次	21	22	23	28	32	126

Key:

a. Number of times
b. Northwestern Hunan
c. Southwestern Hunan
d. Northern Hunan
e. Central Hunan
f. Southern Hunan
g. Total
h. Nature of drought
i. Summer drought
j. Dog days drought
k. Continuous mid-autumn drought
l. Autumn drought
m. Continuous summer and autumn drought
n. Total number of times

In addition to the aforementioned cold waves, flooding and waterlogging, drought, and such meteorological disasters are the effects of freezing, high winds, and hailstorms. During the present century, the province has had six fairly large freezes, three of which have been severe. This means the freeze cycle is about once every 25 years. The 1905 freeze and the 1929-1930 freeze before liberation, and the 1954-1955 major winter freeze after liberation caused losses for forestry throughout the province, and citrus output fell from 500,000 dan to 200,000-odd dan. The low temperature and winter freeze of 1968-1969, and the big freeze of January and February 1977 dramatically reduced citrus output throughout the province. High winds can occur in any season, but mostly occur during spring and summer, wind velocity being greatest in lake regions. High winds also occur most frequently in the lake regions and in the lower reaches of the four rivers. Hailstorms occur mostly between February and April and most of them on both sides of the Xuefeng range and in the Wuling mountain region. Each hailstorm wreaks havoc along a long narrow strip.

In view of the foregoing, in order to insure consistently high yields in agriculture and obtain all-around bumper harvests, it is necessary both to upgrade steadily the utilization rate of climatic data and to master gradually the laws governing changes in the weather, as well as to take various defensive measures to reduce or avoid the effects of natural calamities.

Third Section. Water Conservancy (Energy) Resources

1. Distribution and Use of Surface Water

(1) Depth of Surface Runoff

Surface runoff comes from precipitation, but other natural and geographic factors also limit it and redistribute it. Average depth of runoff throughout the province in most years has been between 500 and 1,500 millimeters (Figure 10). Area dispersal is virtually synonymous with the annual distribution of rainfall. There are three high value areas: (1) The middle and lower reaches of the Zi Shui and Yuan Shui, and the east side of Wuling Shan centering around Taoyuan form concentration areas that have between 800 to 1,200 millimeters. (2) Along Hunan Province's northwestern border north of Sanzhi on the Li Shui, the high value center has 1,500 millimeters. (3) The area between Yangming Shan and the Xiang Jiang forms a small high value area that has 1,200 millimeters of runoff. In addition, the Mufu Shan, Wanyang Shan and parts of Xuefeng Shan also are high value areas. Two low value areas are: (1) The Jiuling tableland between the Xiang and the Zi rivers south of the Binhu Plain where runoff is less than 700 millimeters. This includes the Hengshao Hills and the Dongting Hu areas, which are low value areas each of which has a runoff of 500-600 millimeters. (2) The western Hunan region in the upper reaches of the Yuan Shui, most of which has a runoff of less than 700 millimeters. There is a very great discrepancy in distribution within similar average runoff depths for many years. During the growing seasons for major crops such as paddy rice, in most places runoff is plentiful early on and scant later. Volume of precipitation during July and August is generally less than the amount of transpiration. Surface runoff is not distributed evenly, and this plus the rise and fall of the terrain and differences in the distance from sources of water makes for variations in use. It is fairly easy to get water along the banks of rivers, but to get water for hillside fields requires the impounding, diversion, or raising of water to meet needs. Though northwestern Hunan is an area of plentiful water, spring drought is frequent as a result of the late arrival of the monsoon season necessitating the storage of water in advance and rushing to plow the fields when the rains do come. In addition to making full use of surface water, central Hunan and western Hunan areas that are short of water or have only moderate amounts of water must divert water from elsewhere or from rivers, moving it from areas of plenty to areas of need. Alternatively, underground water resources may be tapped and used in conjunction with surface water to solve the water shortage problem. Though the amount of water that is available and ways of using it differ from place to place, all must control it, store, and release it in an equitable manner, and regulate surfeit and shortage.

(2) River Runoff and Water Energy

Hunan Province is characterized by a dense river network, and a complete water system. It has a substantial amount of water and fairly plentiful water power that does not freeze in winter and that contains little silt. It has 5,341 large and small streams of 5 kilometers or more in length

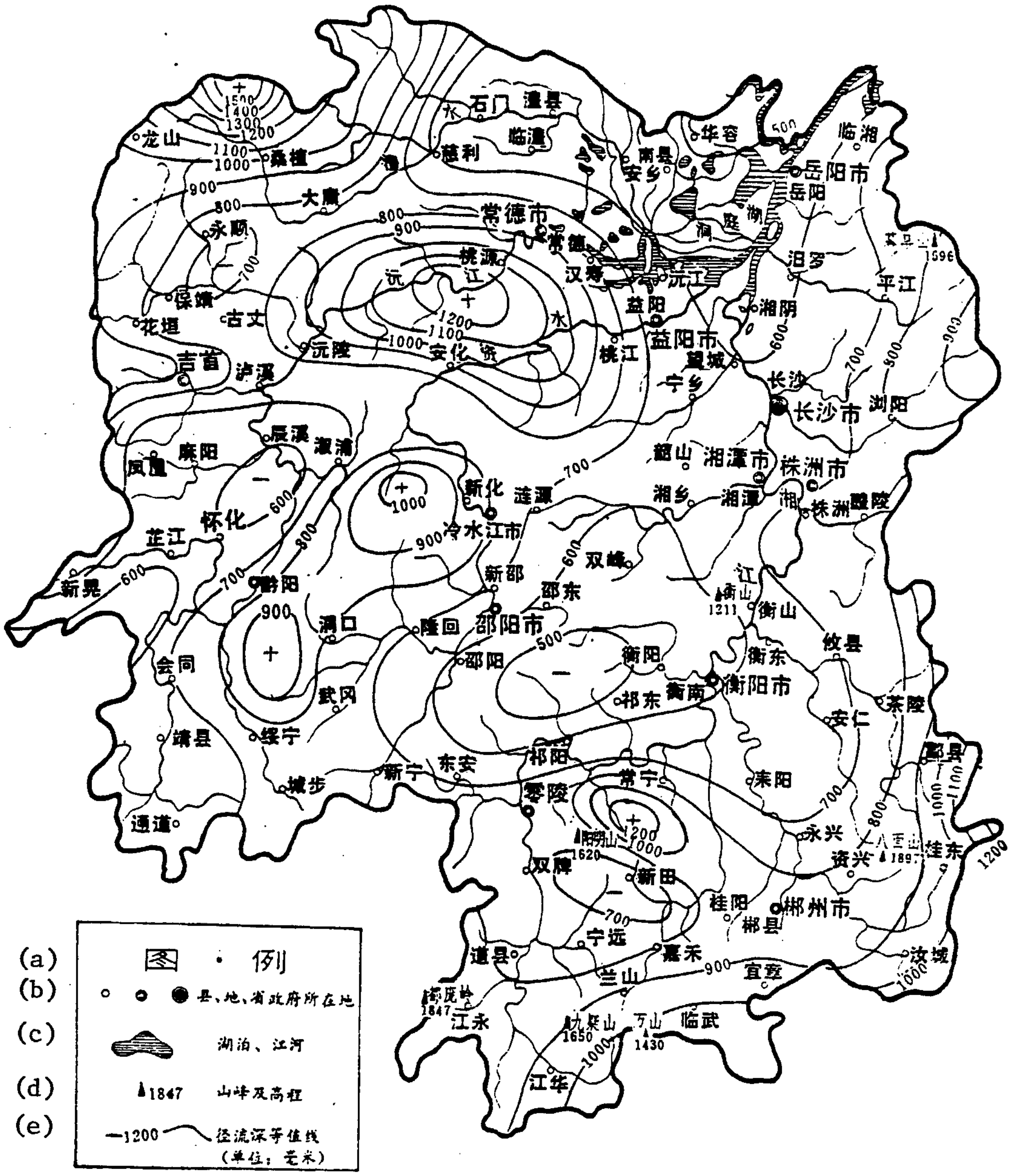


Figure 10. Isopleth Map Showing Annual Runoff Depths for Hunan Province

Key:

a. Legend
b. Location of county, prefecture, or provincial governments
c. Lakes, rivers
d. Mountain peaks and elevation
e. Runoff depth isopleth (Units: millimeters)

totaling more than 43,000 kilometers. Seventeen of these have a drainage area of more than 5,000 square kilometers, and 98 have a drainage area of from 500 to 5,000 square kilometers. Those with a drainage area of less than 500 square kilometers number 5,226. The Zhu Jiang water system and the Gan Jiang water system account for an extremely small portion of the total, but the drainage area of the Xiang, Zi, Yuan, and Li rivers covers 230,500 square kilometers, 77.6 percent of which is in Hunan Province. Average volume of runoff of these rivers in most years is 192.5 billion cubic meters, water volume from the Yuan Shui being greatest accounting for 39.6 percent of the total. Next is the Xiang Shui with 37.7 percent, the Zi Shui with 14.1 percent, and the Li Shui with only 8.9 percent (Figure 11 and Table 9). Total volume of water in the province's rivers amounts to 23 percent of the total volume of water in the Chang Jiang basin, and is again as much as the total volume of water in the Huang He, Huai He, and Hai He basin. The four rivers connect large and small tributaries, flow across the land, converge on the Dongting Hu, and continue on into the Chang Jiang to form an extraordinarily complete water system. Analysis of data from the past 10-odd years shows distribution of flow from the mainstreams of the four rivers to be as follows: greatest volume from the Yuan Shui in 8 years out of 10 followed by the Xiang Shui, and the Li Shui, with the Zi Shui contributing least. During low water, lowest volume of flow comes from the Yuan, Xiang, Zi, and Li in that order. In recent years, the number of large sluice gates, dams and pumping machines have steadily increased, affecting volume of flow during flood and low water seasons. Appreciable control of water level during the dry season has been affected on the middle and upper reaches of the Xiang Jiang.

The rivers contain abundant water energy reserves, which have been calculated at an average 13.38 million kilowatts in most years. The Yuan Shui has the most plentiful reserves with 42.8 percent of the total. The Xiang Shui has 29.6 percent, the Zi Shui 13.8 percent, and the Li Shui and other water systems 10.4 and 3.3 percent respectively. These water systems contain 2.3 percent of the country's total energy reserves, and occupy first place among the country's nine southern provinces. However, as a result of the uneven distribution of runoff during each year, only 2.28 million kilowatts of reserves can be 95 percent guaranteed during the dry season. This is only 17.1 percent of the average annual energy reserves. Of all the water systems, the disparity is particularly great for the Li Shui. Most of the water energy is concentrated in the upper reaches of the rivers and in the gorge areas in the middle and lower reaches of main streams. Reserves are substantial in the Qianyang, autonomous region, Lingling, and Chenzhou areas, and slight in the Yueyang and Yiyang areas.

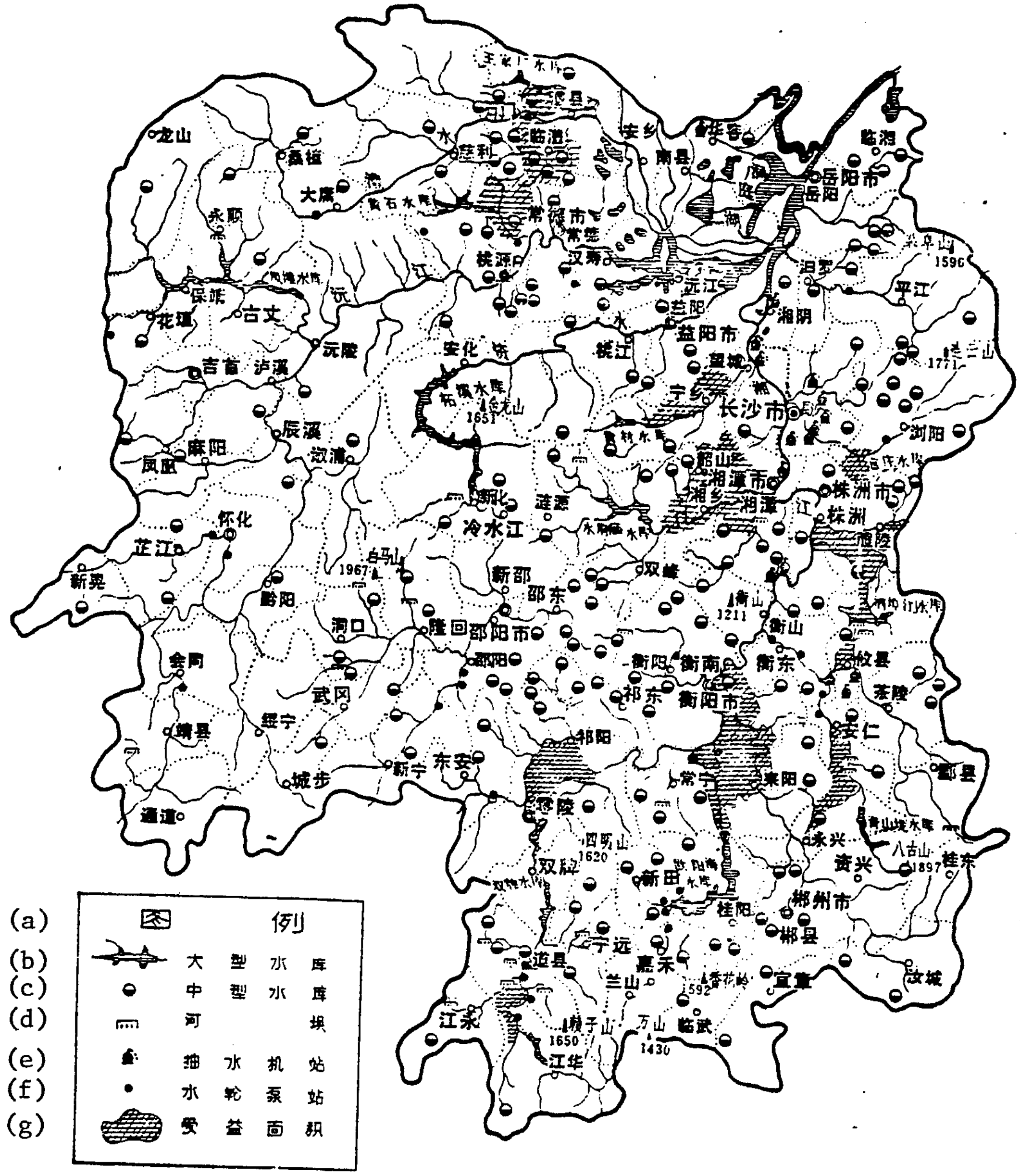


Figure 11. Major Water Systems and Water Conservancy Projects in Hunan

Key:

a. Legend
b. Large reservoir
c. Medium size reservoir
d. River dam
e. Pumping station
f. Waterwheel pumping station
g. Benefited area

Table 9. Characteristic Values for Hunan's Major Water Systems

(a) 水系	(b) 发源地	(c) 河口	(d) 干流长度 (公里)	(e) 湘境里程 (公里)	(f) 流域面积 (平方公里)	(g) 水位 (米) (h) 测站	(i) 年平均	(j) 多年最高	(k) 多年最低	(l) 流量 (m) 年径流总量 (亿米³)	(n) 多年平均流量 (米³/秒)	(o) 最大流量 (米³/秒)	(p) 最小流量 (米³/秒)	(q) 流量比率	(r) 河道平均坡降 (‰)	(s) 水能蕴藏量 (万瓩)
(t) 湘江	(u) 广西临桂县海洋坪龙门界	(v) 湘阴县濠河口	856	670	94660 (湘境85383) (w)	(x) 湘潭	30.59	41.21	27.70	633.7	2393	20300	100	203	0.134	397
(y) 资江	(z) 城步县北青界山黄马界	(aa) 益阳县甘溪港	630	630	28142 (湘境26738) (ab)	(ac) 桃江	35.15	43.82	33.38	213.4	717	15300	10	1530	(ad) 建有拱水库未计	184
(ae) 沅水	(af) 贵州都匀县云雾山鸡冠岭	(ag) 常德市德山	1033	563	89163 (湘境51066) (ah)	(ai) 桃源 (王家河)	45.78	60.00	43.49	662.5	2199	29000	188	154	0.594	573
(aj) 澧水	(ak) 桑植县杉木界	(al) 津市小渡口	388	388	18496 (湘境15505) (am)	(an) 津市	33.71	41.56	30.81	148.1	492	12300	11.8	1042	0.788	139
(ao) 东洞庭湖区		(ap) 由城陵矶入长江			(2685)											
(aq) 南洞庭湖区		(ap) 由城陵矶入长江			(6841)											
(ar) 西洞庭湖区		(ap) 由城陵矶入长江			(1928)											31
(as) 四口水系					(1621)											
(at) 黄盖洞		(au) 由湖北太平口入长江			(661)											
(av) 干江水系	(aw) 汝城县牛木塘	(ax) 由巢境圩流入江西	(50)	50	(493)											
(ay) 北江水系	(az) 临武县三峰岭	(ba) 由罗家洞流入广东	(147)	147	(4289)										1.49	14
(bb) 西江水系	(bc) 广西恭城南县凤岭		(73)		(992)										4.58	

* In this table, Nan Shui in Beiyuan is taken as the source; the Fuyi Shui, a tributary to the Tongmu Jiang that rises in Ziyuan County, Guangxi Province is also a source.

[Key on following page]

Key:

a. Water system
b. Source
c. Mouth of river
d. Length of main stream (kilometers)
e. Distance within Hunan Province (kilometers)
f. Basin area (square kilometers)
g. Water level (meters)
h. Measuring station
i. Annual average
j. Maximum in most years
k. Minimum in most years
l. Flow
m. Total annual runoff (100 million cubic meters)
n. Average runoff in most years (cubic meters per second)
o. Maximum volume of flow (cubic meters per second)
p. Minimum volume of flow (cubic meters per second)
q. Flow ratio
r. Average stream gradient (0/00)
s. Water energy reserves (10,000 kilowatts)
t. Xiang Jiang
u. Longmenjie, Haiyangping, Lingui County, Guangxi
v. Hao Hekou, Xiangyin County
w. 85,383 within Hunan
x. Xiangtan
y. Zi Jiang
z. Huangmajie,* Beilqingjie Shan, Chengbu County
aa. Ganqi Gang, Yiyang County
ab. 26,738 within Hunan
ac. Planned building of Zeqi Reservoir not complete
ad. Jiantuoxi Reservoir not yet planned
ae. Yuan Shui
af. Jiguan Ling, Yunwu Shan, Duyun County, Guizhou
ag. Deshan, Changde City
ah. 51,066 within Hunan
ai. Taoyuan (Wangjia He)
aj. Li Shui
ak. Shanmujie, Sangzhi
al. Xiaodukou, Jin City
am. 15,505 within Hunan
an. Jin City
ao. Eastern Dong Ting Hu region
ap. Enters Chang Jiang at Chenglingji
aq. Southern Dong Ting Hu region
ar. Western Dong Ting Hu region
as. Sikou water system
at. Huanggaidong
au. Enters Chang Jiang at Taipingkou, Hubei
av. Ganjiang water system
aw. Niumu Tang, Rucheng County
ax. Enters Jiangxi at Jilongyu
ay. Beijiang water system
az. Sanfeng Ling, Linwu County
ba. Enters Guangdong at Luojiadong
bb. Xijiang water system
bc. Fengling, Gongchengnan County, Guangxi

1. Xiang Jiang. The mainstream of the Xiang Jiang enters Hunan from Miaotou where Guangxi borders on Hunan. The stretch of the river from Lingling to Hengyang is its middle reaches, and the lower reaches are farther on. It flows a distance of 670 kilometers through 17 counties and municipalities and has a 96 meter drop. Its basin within Hunan Province covers about 39 percent of the province's total area, and its network reaches into 43 counties, the mainstream and mountainlands in the upper reaches of tributaries accounting for 50 percent of the basin, with hills and flat land (including valleys and plains) accounting for 30 percent and 20 percent respectively. The mainstream is a river valley in the prime of life. Except for some constricted sections, most of the valley is relatively wide and gently sloping. The river bed is basically stable, and the volume of water it carries fairly abundant. It carries an average of 65 billion cubic meters of water annually into Dongting Hu. The Xiang Jiang has numerous tributaries, 2,157 large and small ones in all. Of these, those with a basin area of more than 2,000 square kilometers number 12. The tributaries form an asymmetrical feather-shaped water system the left shore of which takes in 68 percent of the total basin area. The most important tributaries are Xiao Shui (354 kilometers long and a drop of 315 meters, with 267,000 kilowatts of power reserves), Chunling Shui (223 kilometers long and a drop of 545 meters, with water energy reserves of 118,000 kilowatts), Lai Shui (453 kilometers long and a drop of 886 meters, with water energy reserves of 413,000 kilowatts), Mi Shui (296 kilometers long and a drop of 817 meters, with 216,000 kilowatts of water energy reserves), Lu Shui (83.4 kilometers long and a drop of 276 meters, with water energy reserves of 101,000 kilowatts), Lian Shui (224 kilometers long and a drop of 163 meters, with 72,600 kilowatts of water energy reserves), Liuyang He (222 kilometers long and a drop of 217 meters, with 163,000 kilowatts of water energy reserves), Laodao He (141 kilometers long and a drop of 297 meters), and Wei Shui (144 kilometers long and a drop of 296 meters), which empty into the Xiang Jiang. This basin has a population of 25,481,700 or 49.4 percent of the total for the province. It has 22,059,800 mu of cultivated land or 42.7 percent of the total for the province including about 84 percent of the province's paddyfields. Most of it is distributed in hills and basins as well as in valleys among the mountains.

Plans for development of this basin's water conservancy (and energy), including building of large and medium size reservoirs at 145 sites for the irrigation of a 9,585,430 mu area, 6,109,800 mu of which is already irrigated. Plans calls for an installed electric power generating capacity of 262,011 kilowatts, of which 166,845 kilowatts have already been installed. Included are medium size and large reservoir projects at eight sites designed to irrigate a 3,608,300 mu area of which 2,542,500 mu is already irrigated, and a designed installed electric power generating capacity of 227,750 kilowatts, of which 154,300 kilowatts has been installed. Water conservancy (and power) resources potential is abundant.

2. Zi Shui. The Fuyi Shui (248 kilometers long) enters Hunan at Meixi in Ziyuan County, Guangxi Province. After the Fuyi Shui converges with the Nan Shui (188 kilometers long) at Shuangjiang Kou, Luojiamiao in Shaoyang, a western tributary, it becomes known as the Zi Shui. The Zi Shui has 771

tributaries large and small, the important ones of which are the Liao Shui and the Pingqi, each of which is 97 kilometers long, the 112 kilometer long Shao Shui, the 76 kilometer long Shima Jiang, the 91 kilometer long Dayang Jiang, and the 99 kilometer long Qu Jiang. The entire water system drains 12 counties. Mountains and hills and low uplands and flat land account for 65 and 35 percent respectively of the Zi Shui area. In the upper reaches mountain region above Xiaomiaotou, the water source is fairly high and the current flows now slowly now rapidly. Farther down at Majitang are the river's middle reaches. Except for the Xinhua area, which is hills, most of the river flows through mountain gorges. The mountain and hill gorges in the river's middle and lower reaches are areas of torrential rains, and damage occurs at Weilu every time there are flood waters. This basin has a population of 8,158,000 and 6,971,200 mu of cultivated land, or 13.5 percent of the province's total. Large and medium size reservoirs are currently under construction at 41 places and are designed to irrigate a 2,983,800 mu area, 1,349,200 mu of which is already irrigated. Designed installed electric power generating capacity is 591,942 kilowatts, of which 455,476 kilowatts have already been installed. The Zhexi Reservoir that is under construction on the mainstream is currently the province's largest hydropower hub with an installed capacity of 447,500 kilowatts. It is the backbone of the central and north Hunan electric power grid, and it also reduces or removes the threat of flooding downstream and to 700,000 mu of farmland in the Weilu area. Work has been completed and benefits are already flowing from the Dachuan Reservoir on the Fuyi Shui tributary.

3. Yuan Shui. This river enters Hunan Province at Zheliang from Luanshan in Guizhou and becomes known as the Yuan Shui after it passes Qiancheng. It has 1,491 large and small tributaries, seven of which are large ones including the Qu Shui (201 kilometers long and with a 278 meter drop), Wu Shui (444 kilometers long and with a 512 meter drop), Wu [1566] Shui (244 kilometers long and with a 485.5 meter drop), Shu Shui (143 kilometers long and with a 361 meter drop), Chen Shui (310 kilometers long and with a 387 meter drop), Wu [2976] Shui (145 kilometers long and with a 351 meter drop), and You Shui (477 kilometers long and with a 658 meter drop) which cut across 21 counties, mostly through craggy mountainlands. Land at an elevation below 200 meters above sea level accounts for only about 10 percent of the area of its flow. The population of this basin is 8,160,900, and it has 9,266,200 mu of cultivated land or 17.9 percent of the cultivated land in the province. Both the mainstream and major tributaries have cut deep river valleys with many shoals and rapids. Annually it carries a flow of 2,100 cubic meters per second into Dong Ting Hu, and during flood stage water volume is great. It frequently collides with flood waters in the middle reaches of the Chang Jiang bringing about flood and waterlogging calamities at the point of convergence. Currently large and medium size water conservancy projects are being built at 40 places on the mainstream and tributaries. They are designed to irrigate 2,087,400 mu of farmland, 1,258,700 mu of which has already been irrigated. Designed installed electric power generating capacity is 18,470 kilowatts, of which 12,350 kilowatts has been installed. It is necessary to continue to make the most of benefits derived from existing projects. The Fengtan hydropower station is now being built on the You Shui tributary, and it has an installed capacity of 400,000 kilowatts.

4. Li Shui. A total of 326 tributaries, large and small, flow into the mainstream of the Li Shui. These include the Lou Shui (250 kilometers long and with a 293 meter drop), Xie Shui (165 kilometers long with a 415 meter drop), Dao Shui (101 kilometers long). These tributaries drain seven counties. The surrounding terrain is high to the west, south, and north, and low to the east, the basin area being 77 percent mountains and about 20 percent hills. In the middle and upper reaches, the mountains are high and the water low; fields are dispersed; the slope of the river is steep; and shoals are numerous. In addition, this basin and the three gorges of the Chang Jiang are part of the same torrential rain zone, and flood waters in the two rivers may collide at Songzi wreaking havoc in the lower reaches. This basin has a population of 2,716,200 and 3,563,800 mu of cultivated land, or 6.8 percent of the total in the province. Current plans call for the building of large and medium size projects at 22 sites on the river to irrigate a 2,182,400 mu area, of which 1,204,500 mu has already been irrigated. Plans call for an installed hydropower capacity of 9,257 kilowatts, of which 5,052 kilowatts have already been installed. Three main projects have already been built in the lower reaches, which not only expand gravity irrigation on the Liyang Plain and nearby low hill areas, but also serve to prevent floods and generate electricity.

5. Other Water Systems. One other water system is the Miluo Jiang (253 kilometers long) and Xinqiang He (108 kilometers long) in Yueyang Prefecture, which flow independently into the lake. In addition to small-scale water conservancy (and power) development, medium size projects (including reservoirs, dams, and waterwheel pumps) now exist at 14 sites, and are designed to irrigate 713,300 mu, 392,500 mu of which have already been irrigated. They also have a designed installed capacity of 10,013 kilowatts of electric power, 9,035 kilowatts of which have already been installed. In addition, medium size projects are being built at five sites on the Wu Shui water system in the southern part of Chenzhou where the river flows into Guangdong. These projects are intended to irrigate 234,500 mu of land, 66,200 mu of which have already come under irrigation, and to have an installed hydropower capacity of 9,925 kilowatts, 2,059 kilowatts of which have already been installed.

To summarize the foregoing, Hunan Province's river water conservancy (and power) resources are abundant. As of the end of 1975, 262 large and medium size reservoirs and irrigation projects had been built or were continuing to be built on the basins of the four rivers, and the actual irrigation area or installed electric power generating capacity of these projects amounted respectively to 58.8 and 72.7 percent of the planned irrigation area and the planned installed electric power generating capacity. Actual installed hydropower capacity as of 1975 was 910,900 kilowatts, which was only about 6.81 percent of total water energy reserves for the province. Plans call for the selection of more than 116 sites suitable for construction of large and medium size reservoirs and dams, and if this development is undertaken, both the irrigated area served and the installed hydropower capacity will be more than 50 percent greater than that of existing large and medium size projects.

(3) Dongting Hu

The Dongting Hu district lies on the south shore of the Jing Jiang and straddles the boundary between Hunan and Hubei covering an 18,780 square kilometer area, 15,200 square kilometers or 80.93 percent of which lie in Hunan. In former times, it was nicknamed the "800 li Dongting" basin. As a result of silting from rivers and reclamation by man, it has been cut up into four lakes, namely the Qili Hu, Muping Hu, South Dongting, and East Dongting. During flood season, the surface of the lake covers an area of about 3,900 square kilometers, and the natural lake area covers 2,740 square kilometers.

The lake currently holds 18.8 billion cubic meters of water. The annual volume of water carried and discharged from the four rivers and the three openings averages almost 400 billion cubic meters. The ratio between the full flood period (June-August) and the dry season (December to March of the following year) is about 8 to 1. Annual variation in water level is around 10 meters.

In most years rivers carry 161.5 billion cubic meters of silt into the lake, 86 percent of it through the four openings. Except for a small amount carried out through Chenglingji, the lake retains about 124 million cubic meters of silt, and the lake basin silt level rises on an average of 4 centimeters each year, thereby steadily reducing the lake surface and volume. The regulatory function of "the lake containing the rise in rivers" that the lake has served over the years has gradually declined. Consequently, varying degrees of waterlogging calamities now occur annually. Since liberation, a series of water conservancy measures have been adopted including blocking tributaries to merge their flow, joining together large embankments, and raising and strengthening dikes. Since the vigorous construction of electric drainage facilities in the 1960's that depend on electric power sources in central Hunan and nearby, it has been possible to guarantee harvests despite drought or waterlogging 75 percent of the time.

2. Types and Distribution of Ground Water

Hunan Province is warm, humid, and receives much rainfall. Its water system is well developed and its terrain rises and falls, all of which helps replenishment and drainage of ground water. In addition, the province's ground strata are complete and its rock is of diverse kinds, resulting in various different kinds of ground water. (1) Void water. Void water is stored in sandy pebble strata and in clastic strata, and is found mostly in lacustrine deposits, in fluvial alluvium, and in terraces as well as in diluvial strata and monadnocks, or over about 20 percent of the area of the province. The water table is generally slightly below the surface and water is plentiful. (2) Crevice water. The sedimentary rock, igneous rock, and the metamorphic rock of mountain and hill regions have varying numbers of joints and crevices, that are particularly well developed within 50 to 100 meters of the ground surface; thus crevice water is found over a wide area throughout the province. However, the quantity of water is generally slight and the depth of its occurrence variable. The amount of

water is substantial only in places near rift and fracture zones. (3) Karst water. Karst water is found in carbonate rock that can be karsted (limestone, dolomite, and marl) where karsting is developed. Precipitation and surface water follows joints in rock strata, crevices and funnels and percolates downward to coverage in underground grottoes to reemerge subsequently in springs and underground rivers. There are 119 fairly large underground streams in the province, some of which carry a volume of from tens of thousands to hundreds of thousands of tons of water in a day and a night and a general depth of 30 meters or less. Furthermore, basin sources of supply of water are widespread and are controlled by the structure of the region, and there are abundant sources of naturally flowing water. There are 32 water impounding structures, most of them in the Lianyuan-Shaoyang area, plus 73 artesian wells in Chenzhou, Shaoyang, Xiangtan, and Hengyang prefectures. Rough estimates show positive reserves of 40.146 billion cubic meters of ground water in the province (or about 19 percent of total runoff). This includes dynamic reserves of karst ground water amounting to between 1.06 and 2.86 billion cubic meters, or an average of 2.08 billion cubic meters per year.

The province's hydrogeology has the following characteristic patterns in terms of rock strata, regional structure and topography:

I. Dongting Hu Plain Void Water Zone

The terrain is flat and elevation above sea level is below 50 meters in most places, and is structurally a basin. The water-bearing petrofabric, the amount of water, the formation of ground water, the depth below the surface, and the movement of water follows a ring pattern from the edges of the basin toward the center. At the center, the lake marsh plain is mostly a quarternary system sandy gravel stratum, which varies in depth from 40 to 140 meters and contains plentiful water. Borings produce a flow of 10 to 30 tons per hour per meter, and in some places flow is greater than 30 tons per hour per meter. The water lies at a very shallow depth beneath the surface at less than 3 meters and generally at 0.5-1.5 meters down. It is fresh water with a neutral pH containing small amounts of calcium dicarbonate. Aquifers are found in the gravel of the mixed alluvium adjacent to the rivers and lakes to a depth of 20 to 60 meters. Borings into these aquifers produce a flow of from 5 to 10 tons per hour per meter, and the water table lies between 0 and 5 meters beneath the surface. The terraces and monadnocks toward the edges of the basin are composed respectively of red earth and pebble strata and of clasolite. Aquifers in the former are less than 20 meters deep, with most of them being between 2 and 10 meters deep. Volume of water from borings is 1-5 tons per hour per meter from a depth of 0-10 meters, and water quality is good. There is less water in the latter, the flow from borings amounting to less than 1 ton per hour per meter from a depth of from 0 to 30 meters. Ground water is plentiful throughout the area, particularly in the lake region where dynamics are stable. It is readily extracted, and it is of importance to water supply and a strategic source of water. However, the ferrous ion content of quarternary system ground water is fairly high and, in some places, industrial effluent has adversely affected phreatic water quality. Thus, attention must be given

the removal of iron and the elimination of pollution to bring the water to standards required for industry and use in daily life. In river and plains lake areas, the ground water table is high, and during the rainy season there is too much ground water and surface water, opening the area to waterlogging. This problem has been generally handled by the digging of ditches to drain away waterlogging and to lower the water table.

II. The Karst Gravity Flow Region of the Central Hunan Hills and Basin

Throughout most of Lianyuan and Shaoyang prefectures, parts of Changsha and Xiangtan prefectures, and the northern part of Lingling Prefecture, limestone and sandy shale hills rise and fall in alternation with the basin. Underground karsting is well developed, and there are numerous water-storing structures concentrated in the Xinhua-Lianyuan and the Longhui-Shaodong areas, as well as in the Xiangtan-Xiangxiang basin area. The karst grotto phreatic water and grotto gravity flow water contained within the limestone and dolomite rock is found in rings that lie in a north/northeast direction. Borings have produced a flow of from 100 to 4,000 tons per day and night, and volume of flow from springs is from 100 to 2,000 tons per day and night. The water table lies 0-30 meters below the ground, and water quality is good. Numerous underground streams are found here with a flow of from 1,000 to 432,000 tons per day and night.

III. The Northeast Hunan Hills and Mountains Weak Crevice Water and Gravity Flow Water Area

This region is located south of the lake region and includes most of Changsha and Hengyang prefectures as well as the eastern parts of Yueyang, Xiangtan, and Chenzhou prefectures. The alluvial gravel strata and the white sand and pit gravel strata along the Xiang Jiang near Changsha and its major tributaries are rich in void water. Borings have produced a flow of between 300 and 800 tons per day and night, and of 2,000 tons per day and night at individual locations. Flow of water from springs is from 300 to 800 tons per day and night. The water table lies about 0-5 meters below ground, and the water is mildly acidic containing chlorine and sodium dicarbonate. The limestone and siliceous rock of Huangfengqiao in Youxian County and of Dazhang County in Liling Prefecture have water-bearing synclines. Borings have produced a water flow of 100-81,000 tons per day and night, and volume of flow from springs is 86-20,000 tons per day and night. The water table lies at a depth of +2-55 meters. The water contains calcium, magnesium, and sodium dicarbonate, and is mildly alkaline. The limestone and dolomite as well as small amounts of silicarenite near Tiaomajian, Chunhuashan, Liuyangyong, and Jingangtou in Changsha Prefecture contain plentiful karst grotto crevice water. Borings produced a flow of 20-1,000 tons per day and night from a depth of 0-20 meters or so. Around the edges of the basin in areas contiguous to red rock and other strata, water volume is also fairly abundant. Northern Mufu Shan in eastern Hunan and the Nanshan region of eastern Hunan are fairly deficient in ground water.

IV. The Southern Hunan Hill and Mountain Region Crevice and Karst Water Region

This region is located in an overwhelming majority of places in Lingling and Chenzhou prefectures as well as in the southern part and small parts of southeastern Hengyang and Xiangtan prefectures. The major aquifers are limestone and dolomite, which contain abundant crevice and karst grotto water. Distribution is uneven; however, most of the water is concentrated in Chenxian, Zixing, Guiyang, and Yizhang in a long, narrow area running from south to north. In the mountainlands from Jiangyong to Daoxian are many limestone rock peaks and forested valleys where karst grotto ground water appears above the surface over wide areas. It is also found here and there in other areas, and borings have produced a flow of 100-7,000 tons per day and night. The region also contains underground streams. Investigation of karst areas in southern Hunan shows 19 beheaded rivers and subterranean streams with a flow of from 3,000 to 30,000 tons per day and night and with a water table running from 0-25 meters. The water is predominantly of neutral pH or mildly alkaline, containing calcium and magnesium dicarbonate.

V. Western Hunan Mountainland Crevice Water Region

This region includes all of Qianyang Prefecture, and the area from the eastern slopes of Wuling Shan to the eastern foothills of Xuefeng Shan. The area is characterized by medium size and low mountains. In areas where surface karsting is developed, shallow valleys and downlands predominate. Ground water is fairly abundant, limestone being the main strata containing plentiful water. These strata pass through the area Yuanling, Chenqi, Shupu, Huaihua, and Jingxian where borings have produced a flow of 400-21,000 tons per day and night. Volume of flow from springs is 40-2,000 tons per day and night. The water table is 0-20 meters, and is above the surface of the ground in some places. Water is either neutral or slightly alkaline and contains mostly either calcium dicarbonate or calcium-magnesium dicarbonate.

VI. The Northwestern Hunan Mountainland Karst Water Region

Most of the mountainlands of Western Hunan Autonomous Zhou are violently cut up and contain numerous precipitous slopes and narrow valleys. The corroded limestone landscape is fairly widespread and shows up in the form of funnel-shaped lowlands or valleys riven with numerous peaks. Underground karst grottoes and underground streams suffuse the area. A survey has revealed 18 fairly large beheaded streams and underground streams. The strata containing plentiful water is mostly limestone, which lies in a northeast-southwest or an east-west direction passing through Huayuan, Baojing, Dayong, Longshan, and Sangzhi. Borings have produced a water flow of 270-5,000 tons per day and night. Flow from springs is 1,000-1,400 tons per day and night. At Jiaoziwan in Sangzhi, and at Kapeng in Baojing, underground river flow is 2,600-345,600 tons per day and night and the water table is at a depth of 0-25 meters. The second most abundant water-bearing stratum is made up of limestone, dolomite, and siliceous limestone,

which is found over a wide area running through Fenghuang, Baojing, Dayong, Zili, Shimen, and Sangzhi. Volume, quality, and temperature of the water suit it to agricultural irrigation.

Ground water resources are closely related to agricultural and industrial production and to the people's daily lives. This is particularly true of Hunan Province's carbonate strata (also termed soluble rock), which account for about 32 percent of the total area of the province. In northwestern, southern, central and southeastern Hunan Province, karsting is fairly well developed, and there is a substantial need for water for agriculture as well. Luota Commune in Longshan County, Changtianwan Commune in Chenxi County, Daqingping Commune in Lingling County, and Changliushui Production Brigade, Zhuozao Commune in Shaodong County, as well as Dalongdong Power Station in Jishou County, Dongfeng Power Station in Yongshun County, and Yingtaoao Power Station in Fenghuang County are models in the active development and use of karst ground water. Incomplete statistics show more than 7,290 sites as having built large, medium and small water conservancy projects and projects for the use of karst water that are able to impound, divert, and lift about 2.3 billion cubic meters of water, irrigate an area of about 4 million mu, and have an installed power generation capacity of more than 50,000 kilowatts.

Hunan Province has fairly abundant underground hot water resources, which are concentrated mostly in the northwestern and southeastern parts of the province, followed by the eastern part of southern sections of the Xuefeng mountainlands as well as in eastern Hunan. Hot water comes mostly from karst crevice aquifers and from fracture zones in granite rock areas. Hot (mineral) water has been found at 72 sites, two of which have high temperature water (80-100°C), one of which has moderate to high hot water (60-80°C), 20 of which have moderately hot water (40-60°C), and 49 of which have low temperature hot water (20-40°C). At 20 famed hot springs such as Shadagou in Longshan County, Reshuikeng in Yongshun County, Mayangping in Dayong County, Reshuixi in Shimendahe Zhou, and Nuanshuijie in Li County, water temperature runs from 30 to 52°C. At more than 20 hot spring sites in places such as Beihu, Jinshuailing, and Matouling in Chen County, at Wentangkou in Yizhang County, Shatian in Linwu County, and Gui City in Zixing County, water temperature runs from 31-49°C. At the hot springs at Wenshui village, Youxian County, the flow is comparatively great. At the Reshuiyu hot springs in Rucheng County the highest water temperature reaches 99°C, and the flow generally 80-1,700 tons per day and night. Water temperature at Tanghuo Springs, in Donghuwei, Leiyang County is 38°C. The hot springs at Huitang in Ningxiang County are controlled mostly by the rifting of eruptive rock, and water temperature is 88°C. Water temperature in wells is 102°C, and water flows at a rate of about 4,000 tons per day and night. Hot springs may be used in the propagation of paddy rice seedlings, for the culturing of tropical crops and tropical fish, for fermentation, for medical therapy, and for the generation of electric power. (The Huitang Geothermal Power Station has an installed capacity of 300 kilowatts.)

Fourth Section. Soil and Plants

1. Agricultural Soil Zones and Use Characteristics

(1) Soil Formation and Sub-zones

Hunan's soil is located in the red and yellow soil belt of the sub-tropical climatic zone. The interrelationship and mutually restrictive interaction of natural conditions such as terrain, mother material, water, heat, and plant cover have brought about soil formation and distribution, which is manifested not only in horizontal belts, but also vertically and in regional differentiation. (1) Differences in elevation above sea level giving rise to vertical differentiation of soil. Though the difference in latitude between north and south in the province is only 5 degrees, cumulative temperature for the year when the temperature is equal to or greater than 10°C is between 5,100 and 5,700°C, with relatively little discrepancy; thus there are no very clear differences in horizontal soil distribution. But terrain elevation varies, and there is considerable difference in vertical water and heat conditions and in vegetation cover; thus there is a definite pattern to soil distribution. River and lake plains are composed mostly of alluvium, while the composition of mountains and hills changes as elevation above sea level increases. Below 500 meters, mostly yellowish red soil and red soil are found; between 500 and 800 meters, yellow soil predominates; between 800 and 1,000 meters, yellowish brown soil predominates; and between 1,000 and 1,400 meters, mountainland brown soil and meadow soil are found. (2) The mother material that has formed the soil is of many different kinds, and soil types vary from place to place. The lithogeology of the province is complex with variations from place to place in the amount of weathering and scouring that has occurred. For example, red earth may develop from various kinds of mother material, including from the weathered products of granite, which produce a fairly thick soil layer that contains an appreciable amount of granules, is acidic, contains much potash and few other nutrients, and that is friable. Soil in purple sandy shale regions occurs in a fairly thin layer, and contains partially weathered debris. It ranges from slightly acidic to slightly alkaline and some produces a lime reaction. It contains fairly high amounts of phosphate and potash plus calcium. Soil from limestone areas may lie in either thick or thin layers. It is strongly coacervative, has a pH that ranges from neutral to slightly alkaline, and contains considerable calcium. Soil formed from Tertiary Era red soil mother material is thick, clayey, strongly acidic, contains large quantities of iron and aluminum, and is deficient in nutrients. Take paddy-field soil, for example. Soil that has developed from alluvial layers and from granite is fairly light; however, its accumulation of total nitrate nutrients is fairly scant. Conversely, paddy soil that has developed from limestone and purple shale is fairly clayey and its total nitrate nutrient content is considerable. Because of the fairly intricate mother materials and biological functions, different types of soil have developed. Thus, within the red and yellow soil zones, soils with a regional quality alternate or are interspersed with each other (Figure 12). (3) Since terrain, water and heat conditions vary, soils have differences in regional characteristics. The Xuefeng and Wuling mountainlands of Xiangxi Prefecture in

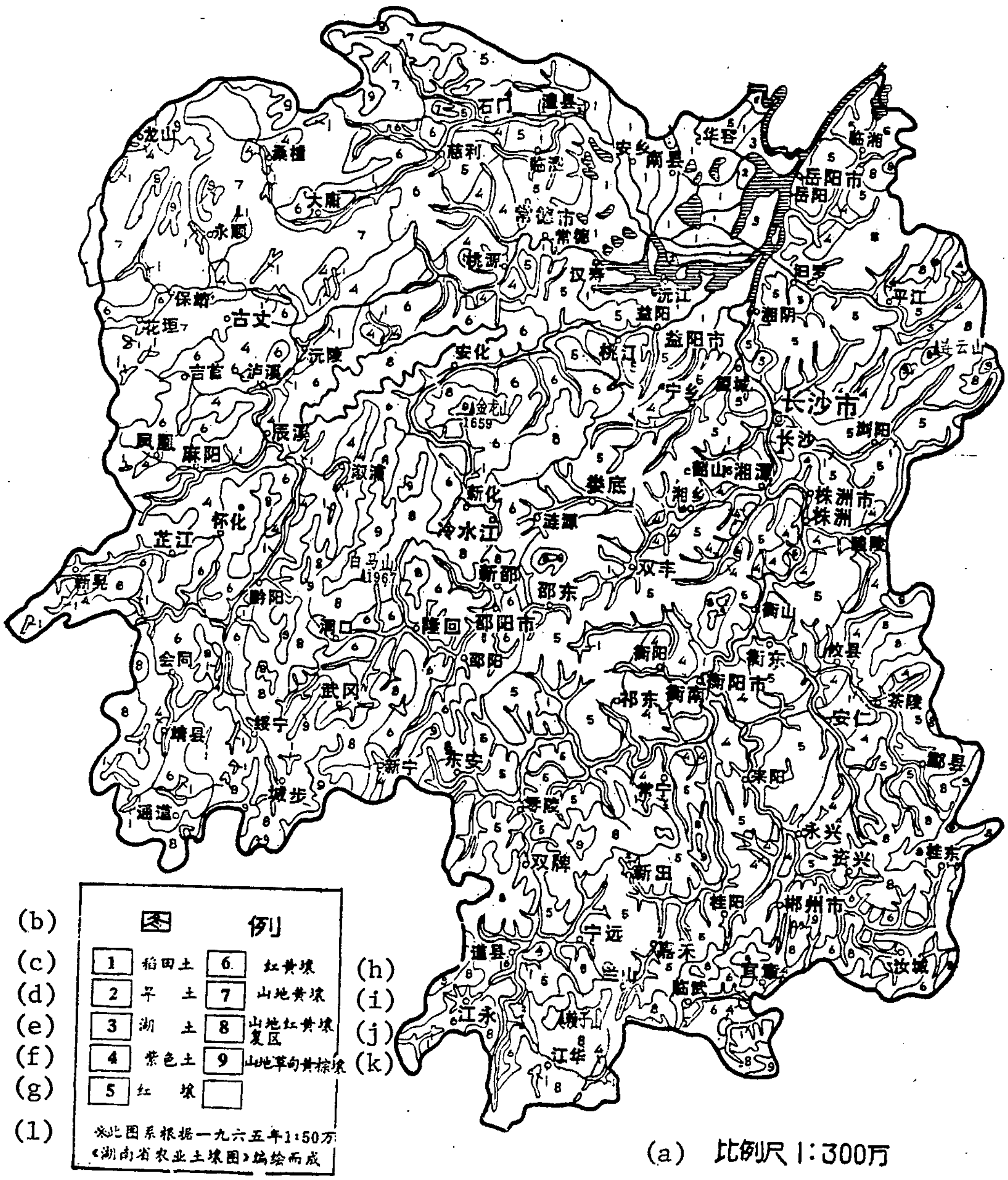


Figure 12. Map Showing Soil Types in Hunan Province

Key:

a. Scale: 1:3,000,000
b. Legend
c. Paddy soil
d. Drylands
e. Lacustrine soil
f. Purple soil
g. Red soil
h. Red and yellow soil
i. Mountainland yellow soil
j. Area recurrence of mountainland red and yellow soil
k. Mountainland meadow and yellowish brown soil
l. *This map is based on the 1965 1:500,000 "Agricultural Soil Map of Hunan Province"

Hunan Province are a part of the eastern edge of the Yunnan-Guizhou Plain. The terrain is high and rolling. The annual change from dry to wet seasons is not sharply defined. Relative humidity is fairly high; changes to the soil resulting from water are fairly great; and distribution of yellow soil on the surface is fairly widespread. To the east of the Xuefeng Shan, summers are hot and winters cold, and there is a marked distinction between dry and wet seasons. Relative humidity is fairly low, and the soil comes mostly from red soil. Red soil predominates in the hills and basins of the Xiang and Zi rivers as well as in the hill regions surrounding the lakes of northern Hunan. (4) In any given area, a certain pattern of soil composition exists. Mountains and hills rise and fall, and river valleys and basins crisscross Hunan Province, and in hill regions a series of soil compositions have formed like branches from tree limbs. In general, as one goes down the slopes of river valleys the succession of soils is red soil (or yellow soil and yellowish red soil), huangni paddy soil [surface submergic southern paddy soil] and huangni soil, qingni soil [gleyed middle paddy soil] (or cold waterlogged fields). They frequently recur continuously or discontinuously. In basin areas, and particularly in the Dongting Hu area, the soil frequently follows a concentric circle pattern. Going from the outer edge of the surrounding hills toward the lake, one finds huangni paddy soil followed by sandy chao soil, chao soil [well drained submergic southern paddy soil], and boggy soil. Differences in elevation of the micro-area topography produce the soil moisture situation. Differences in organic matter content and pH also produce a series of micro-region incremental distinctions.

The following five agricultural soil areas may be summarized on the basis of soil development and local characteristics, plus the types of soil make-up:

I. The Dongting Hu Plain Alluvial Soil and Sandy Chao Soil Area

The mother material from which the soil derives consists mostly of alluvial lacustrine strata. The fringe uplands are composed mostly of tertiary system red rock strata. The quarternary system red soil overlay has bits of metamorphic rock and granite in it. The general pattern of occurrence of all soils is in rings. The fringe uplands crisscross red soil and purple soil plus some slope huangni soil and flatlands qingni soil. The four openings flood discharge area as well as the river tidal flats of the four rivers sinks are composed primarily of alluvium and sandy chao soil. The paddy soil of the central plain is in a continuous tract, and under influence of the water flow it goes from high to low as the surface of the land gently rises and falls. In general, the soil quality goes from the coarse to the fine, and the cultivated layer goes from the shallow to the deep. Most of the paddy soil has the following characteristics:

(1) Depth of the soil layer is mostly more than 1 meter, and the alluvial layer is interspersed with sandy soil layers. The capability of the soil to retain water and fertilizer is related to the order in which the layers of silt occur and their thickness. Some soil also has a layer of semi-decomposed organic material sandwiched into it.

(2) The soil contains a moderate amount of gravel, 30-70 percent of it having a diameter greater than 0.01 millimeters. The texture of the soil is between intermediate soil to light clay; it is friable and relatively easily cultivated.

(3) The soil's natural fertility is generally high. Annually large amounts of silt are deposited, the source being rich topsoil from everywhere. In addition, all sorts of nutrients are dissolved in the water; thus the soil's nutrient content is plentiful and the pH ranges from neutral to mildly alkaline making it favorable for the movement of microorganisms that promote crop growth.

(4) The ground water table is high, and the soil is strongly influenced by the water. At places where the soil is at different depths, qingni layers have developed, and when the qingni layer is overly high, it has a definite effect on soil porosity. Low-lying paddy fields contain stagnant water all year round. The reduction function in these fields is strong; breakdown of nutrients is slow; soil is fairly deep; and fertility is fairly low.

Most of the fields in this region have been reclaimed from the lake for cultivation. The growing of green manure in winter is fairly universal; crop outputs are fairly high; and the region is a grain base for the province. The region lends itself to an intensification of safeguards against flooding and drainage of stagnant water, the digging of ditches to provide drainage, lowering of the water table, improvement of deep mud fields, making new sources of manure, and building up soil fertility.

II. The Northeastern Hunan Hill and Low Mountain Red Soil and Sandy Soil Region

The mountains and hills are composed mostly of phyllite, slate, and granite interspersed with tertiary system red rock strata and quarternary system red rock, which form the mother material from which the soil was made. As a result of the influence of various soil formation conditions, the soil has the following main characteristics:

(1) It is primarily red soil, with slight variations resulting from differences in mother materials. The soil layer that developed from the quarternary system red soil layer is fairly thick, and in the bottom layer one often sees dyktyonite and ferro-manganese illuvium, which contains few nutrients, is strongly acidic, has a high clay content, and is fairly drought resistant. Tea oil plants grow very well in it.

(2) Paddy soil is found mostly in alluvial valleys, basins, and in river bank terraces. Going from high to low, the order of occurrence of various soils is huangni soil, blue intercalated soil, and sandy soil. The first one has developed out of illuvial mother material; the last two have developed out of alluvial mother material. In alluvial valley areas, the ground water table is fairly high. At more than 50 centimeters below the surface, a qingni layer frequently forms in wetlands, which serves both to conserve water and supply moisture.

(3) Historically cultivation has been fairly intensive; soil nutrient content has been fairly plentiful; and fertility has been generally high.

Circumstances in the central Hunan hills and basins are similar, but may be divided into eastern and western parts.

III. The Changsha-Hengyang Hill and Basin Red Soil (Purple Soil) and Huangni Soil (Zini Soil) Area

The mother material from which the soil has formed was tertiary system red rock layers as well as quarternary system red soil. The periphery was interspersed with sandstone, slate and shale, limestone, and some granite. Except for the mountains, most of the soil was purple soil interspersed with some red soil. Composition of paddy soil from the hill slopes to the alluvial valleys goes from red gravelly soil to zini soil to sandy chao soil and cold waterlogged fields. Principal characteristics of the soils are as follows:

(1) Purple soil mother rock weathers rapidly and is easily corroded. The soil layer is not thick, and it is frequently intercalated with semi-weathered debris. Generally phosphate and potash content is abundant, but organic and total nitrogen content is fairly low. The pH runs from neutral to mildly alkaline. The soil is prone to dry out or become wet and is poorly resistant to drought. It is suitable for the growing of beans, sweet potatoes, and wheat plus fruits such as oranges and dates.

(2) Results from fertilizing wetlands with nitrate and organic fertilizers are remarkable. Since the soil is fairly clayey, it is prone to form large cracks once it dries out making for considerable difficulties in cultivation. Care must be taken to conserve water and soil and to store water against drought, to increase the amount of green manure per unit of area, and to maintain a certain ratio of rice to pulses.

IV. Lianyuan-Shaoyang Hills Red Soil, Huangni, and Yashini Soil Area

The hub of this region is the twin peaks in Shaodong County, and the region takes in the long, narrow area that runs from south to north through parts of neighboring Lingling, Shaoyang, and Yiyang prefectures. The mother material that formed the soil is mostly limestone, with some shale, silicarenite, and phyllite, most of which has produced red soil, but also some purple soil and yellow soil. The composition of paddy soil in terms of moistness from top to bottom generally follows the order of intercalated yellow soil, shallow yashini soil and deep yashini soil. Characteristics of soil in this region are as follows:

(1) Soil color is yellowish red or reddish brown. The soil layer is generally shallow particularly in limestone areas where the mother rock is frequently exposed. The soil is fairly clayey, contains calcium, and its pH runs from slightly acidic to slightly alkaline.

(2) Paddyfield soil is lacking in organic matter but contains plentiful calcium. If dehydrated and dried out, the soil particles form clods that are not easily softened. This soil is also lacking in phosphate, which hurts yields. In order to make use of the soil, water conservancy construction should be increased, green manure grown, and phosphate fertilizer added to improve low yield fields.

V. Southern Hunan Mountainland and Hill Red and Yellow Soil, and Huangni and Yashini Soil Region

This soil is found in most of Lingling and Chenzhou counties. The mountain ranges rise and fall revealing the vertical distribution of the soil. The mother material from which the soil has formed was mostly limestone, plus some granite, silicarenite, phyllite, and red rock. Running along the gentle slopes of the foothills and valleys to the river shores is a narrow plain on which the wetlands soil is composed of rock debris, intercalated huangni soil, huangni soil, yashini soil, and cold waterlogged fields in that order of precedence. Principal characteristics of the soil are as follows:

(1) The red soil layer is generally fairly thick, but the yellow soil layer is fairly thin. Organic content of the surface layer of the former is higher than for the latter. Soil developed from limestone sticks together and is not easily broken up. Results of fertilization show up only slowly. Soils made from sandy shale often contain intercalated rock tailings or debris. Tea oil plants grow well in it.

(2) Shading by mountains and the effects of springs have produced a certain proportion of cold waterlogged fields in which cereal grain seedlings grow rather slowly. Yashini soil is clayey and forms clods easily that frequently have to be broken up. Generally this soil is fairly rich in nutrients, but it requires the digging of ditches to drain away waterlogging, fertilization with phosphate, and improvements in the farming system to nurture fertility.

The western Hunan mountainlands are found mostly on the west side of the mainstream of the Zi Shui and in the basins of the Yuan and Li rivers. The landscape is one of clusters of mountain ranges with steep slopes and deep valleys interspersed with some basins. The lithogeology is mostly phyllitic shale, sandstone, slate, limestone, Nantuo drift sheet, red rock, and Quarternary Era boulder clay strata. The region may be divided into northern and southern parts.

VI. Southwestern Hunan Mountainland Yellow Soil, Red Soil (Purple Soil) and Huangni Soil Region

Because the terrain rises and falls greatly, the vertical zoning of the natural soil is obvious. The order of paddyfield soils going from high to low terrain is rock debris soil, huangni soil, cold waterlogged yashini soil, and sandy soil. In hill basins the soil is made up of yellowish red soil (or purple soil) and huangni soil (or zini soil). Characteristics of

the natural soil are as follows: Obvious stratification, the upper part being a thin humic layer and the lower part being an orange or light yellow layer running from 30-50 centimeters to 100-150 centimeters thick below which lies weathered mother rock material. The hill region is made up mostly of Quarternary Era alluvium and weathered limestone. The soil is mostly clayey and the soil layer is fairly thin; however, soil nutrient content is fairly plentiful and acidic.

VII. Northwestern Hunan Mountainland Yellow Soil and Huangni Soil Area

The pattern of soil distribution in the northwestern Hunan mountainlands, its characteristics and fertility are fundamentally similar to the soils of southwestern Hunan. However, the topography of northwestern Hunan is higher and largely made up of a series of mountain peaks, mountain plateaus, and karsted hills and lowlands. Conditions for the impounding of water are poor so a large percentage of the land is drylands.

(2) Types and Characteristics of Soils

Frequently encountered types of paddy soils and drylands soils and their characteristics as shown in general survey data are presented and analyzed in succeeding Tables 10, 11, and 12. It is worth noting that fertility of all types of soils is discussed in relative terms. With the passage of time and as a result of a series of measures such as cultivation and fertilization, scientific farming and capital construction of agriculture, formerly low yield fields may be converted into high yield fields, and high yield fields can be made to produce even higher yields.

In Hunan Province, high yield rice paddy soils are generally found on river valley plains among the hills and in areas around lakes, particularly in areas near cities, towns, and rural villages where sunshine, availability of manure and water, and the labor force permit. Indicators for high yield paddyfields include depth, softness, tilth, and fertility of soil. Generally the cultivated layer is 6-7 cun deep, and the ratio of clay to sand is 7:3 or 6:4. Most such soils are good quality intermediate or heavy soils, with an organic matter content of around 3 percent, an 0.2 percent total nitrogen content, an 0.15 total phosphate content, and a phosphate content of more than 2.5 percent. The pH of the soil is close to neutral, and moisture content can vary. In addition, the surface of fields is level, and soil granules are moderate in size. These conditions are determined not only by natural causes but also by a series of measures such as intensivity of cultivation and nurturing of fertility, free and easy irrigation and drainage, sensible crop rotation, and combining of use and nurture of the land. Clearly a very great potential exists for improving the fertility of fields in Hunan Province.

Table 10. Statistical Analysis of Wetlands Soils

等级 (a)	土种 (c)	面积 (n) 合计 (o) (亩)	面积 (n) 占稻田 (p) (%)	养分含量 (q) 酸度 (r) (盐度)	有机质 (s) (%)	全量氮 (t) N%	全量磷 (u) P_2O_5%	全量钾 (v) K_2O%	速效磷 (w) 斤/亩	速效钾 (x) 斤/亩	分布 (y)
(d)	潮沙泥	2,638,924	6.14	5.2～6.1	2.369	0.155	0.077	2.525	10.4	28.2	四水干支流河湾带、沙泥田之下，易受洪水影响。 衡阳、衡南、新邵 (z)
(e) 高	潮泥田	1,500,682	3.49	6.3	1.687	0.137	0.094	2.427	24.5	24	四水干支流两岸平原或湖沙泥之上，土泥田或黄泥田之下。 黔阳 (aa)
(f)	泥夹沙	1,493,247	3.47	7.8	1.976	0.150	0.105	3.094	7.2	31.2	以南县、华容、安乡、沅江为多，一般位于河头子泥田潮泥田之间。 沅江 (ab)
(g) 产 (b)	沙夹泥	583,364	1.36	7.7	1.035	0.071	0.111	2.405	7.3	10.2	潮沙田和泥夹沙田之间，处于急流洪峰边缘，四水尾间。 湖区、沅江 (ac)
(h)	泥田	1,933,024	4.5	7.7	1.854	0.137	0.114	2.989	7.6	22.2	内湖沿岸，离居民点稍远的低平地区。 沅江 (ad)
土 (i)	黑沙泥	1,441,521	3.35	6.0～6.7	4.284	0.245	0.137	1.792	9.6	37.7	山丘垅田或距河溪稍远的坪田。 溆浦、双峰、常宁 (ae)
(j)	黑泥田	1,629,883	3.79	5.8～7.5	3.516	0.198	0.102	1.758	7.2	37.3	丘陵区垅冲居民点附近，花垣、溆浦、醴陵。 宜章 (af)
壤 (k)	青沙泥	204,514	0.48	5.8～6.3	2.195	0.147	0.082	2.238	11.4	28.6	湘西北桑植、大庸、永顺 、龙山、保靖及黔阳、山丘平田、坡田。永兴、大庸 (ag)
(1)	土泥田	1,075,349	2.5	6.9	2.529	0.183	0.102	1.539	5.1	64	丘陵区垅田或排田。 新化。 (ah)
(m)	合计	12,502,508	29								

Key:

a. Category
b. High yield soil
c. Kind of soil
d. Sandy chao soil
e. Chaoni soil
f. Soil intercalated with sand
g. Sand intercalated with soil
h. Argilla
i. Black sandy soil
j. Heini soil
k. Blue sandy soil
l. Tuni soil

m. Total
n. Area
o. Total (mu)
p. Percentage of paddyfields
q. Nutrient content
r. Acidity (salinity)
s. Percentage of organic matter
t. Percentage of total nitrogen N%
u. Total phosphate P_2O_5
v. Total potash K_2O
w. Quick acting phosphate (jin per mu)
x. Quick acting potash (jin per mu)

[Key continued on following page]

y. Distribution

z. In bends of the mainstreams and tributaries of the four rivers; below sandy soil fields, and in places prone to flooding. Hengyang, Hengnan, Xinshao.

aa. Atop sandy chaoni on plains on both banks of the mainstream and tributaries of the four rivers, and beneath tuni soil or huangni soil. Qianyang.

ab. Mostly in Nanxian, Huarong, Anxiang, and Yuanjiang counties; generally found between ni soil and chaoni soil at heads of rivers. Yuan Jiang.

ac. Between sandy chao soil and soil intercalated with sand. Found on the edges of fast current flood peaks and at the convergence of the four rivers. Lake region and Yuan Jiang.

ad. Shores of inner lake on lowlying flatland areas slightly distant from inhabited areas. Yuan Jiang.

ae. Ridged fields in mountains and hills, or level fields a slight distance from rivers and creeks. Shupu, Shuangfeng, Changning.

af. Ridged alluvial hill regions near inhabited areas. Huayuan, Shupu, and Liling. Yizhang.

ag. Sangzhi, Dayong, Yongshun, Longshan, Baojing and Qianyang in northwestern Hunan; level fields and hillside fields in mountains and hills. Yongxing and Dayong.

ah. Ridged fields or paitian [2226 3944] in hill regions. Xinhua.

Table 11. Statistical Analysis of Wetlands Soils

(a) 等级	(c) 土种	面 (m) 积: (n) 小计 (亩)	(o) 占稻田 (%)	(p) 养分含量: (q) 酸度 (盐度)	(r) 有机质 (%)	(s) 全量氮 N%	(t) 全量磷 P_2O_5%	(u) 全量钾 K_2O%	(v) 速效磷 斤/亩	(w) 速效钾 斤/亩	分 (x) 布
(b) 中产土壤	(d) 黄沙泥	1,861,375		4.7～6.8	2.509	0.163	0.086	1.923	8.6	21.1	零陵分布山丘缓坡、溪旁、以湘西、湘东、湘中为多，居梯田二排田。如永、衡、邵、黔、长等地 (y)
	(e) 红沙泥	964,314		4.5～6	1.510	0.086	0.038	1.183	6.9	52.8	同 上 黔阳、龙山 (z)
	(f) 白沙泥	494,451		6.2	1.345	0.072	0.051	1.984	4.0	17.4	丘陵坡地及山地中上部少量分布．邵阳地区及汝桂、长沙、湘阴、岳阳、宁乡、平江． (aa)
	(g) 大眼泥	1,851,272		6.0～8.4	1.769	0.138	0.124	2.109	27.4	41.4	丘陵紫色土地带的排田、垅田。常宁、衡阳、衡南、祁东、祁阳、东安、浏阳、攸县、桃源、溆浦、麻阳 (ab)
	(h) 大眼黄泥	43,479									垅田中上部、地势平缓、集中分布衡南、耒阳、麻阳。 (ac)
	(i) 白鳝泥	426,655	0.90	4.8～7.0	2.404	0.159	0.055	2.262	10.0	40.9	山丘缓坡台地，以花垣、宁远、怀化、道县为多． (ad)

[Continued on following page]

Table 11 (Continued)

(a) 等级	(c) 土种	(m) 面积 (n) 小计 (亩)	(o) 占稻田 (%)	(p) 养分含量 (q) 酸度 (盐度)	(r) 有机质 (%)	(s) 全量氮 N%	(t) 全量磷 P_2O_5%	(u) 全量钾 K_2O%	(v) 速效磷 斤/亩	(w) 速效钾 斤/亩	(x) 分布
	(j) 黄泥	6,742,273	15.68	4.8～8.5	2.207	0.146	0.082	1.633	8.0	26.8	山丘较低的排田及河岸台田、平田地势开阔，水利好。(ae)
	(k) 浅脚鸭屎青夹泥	2,979,027									前者分布山丘垅冲较高部位，后者属于浅脚鸭屎泥，受水作用较小。(af)
	(l) 合计	15,362,844	35.7								

Key:

a. Category
b. Intermediate yield soils
c. Kind of soil
d. Sandy huangni
e. Sandy hongni
f. Sandy baini
g. Dayanni [large pore soil]
h. Dayan huangni [large pore huangni]
i. Baishanni
j. Huangni
k. Shallow intercalated blue and yashini soil
l. Total
m. Area
n. Total (mu)
o. Percentage of paddyfields
p. Nutrient content
q. Acidity (salinity)
r. Percentage of organic matter
s. Percentage of total nitrogen N%
t. Total phosphate P_2O_5
u. Total potash K_2O
v. Quick acting phosphate (jin per mu)
w. Quick acting potash (jin per mu)
x. Distribution
y. Found on the gentle slopes of mountains and hills and along streams in Lingling, largely in western, eastern, and central Hunan on terraced fields and erpaitian [0059 2226 3944] in places such as Yongfeng, Hengyang, Shaoyang, Qianyang, and Changsha.
z. Same as next above. Qianyang and Longshan.
aa. Small amount of distribution on hill slopes and in middle and upper portions of mountainlands in Shaoyang Prefecture, and in Rugui, Changsha, Xiangyang, Yueyang, Ningxiang, and Pingjiang counties.
ab. On paitian and ridged fields in purple soil area of hills. Changning, Hengyang, Hengnan, Qidong, Qiyang, Dongan, Liuyang, Youxian, Taoyuan, Shupu, and Mayang counties.

[Key continued on following page]

ac. On middle and upper portions of ridged fields, gently sloping terrain, scattered in Hengnan, Laiyang and Mayang.

ad. On gentle slopes of mountains and hills and on tablelands, mostly in Huayuan, Ningyuan, Huaihua, and Daoxian counties.

ae. Paitian in fairly low mountains and hills and on river shore raised fields, on broad expanses of flat fields where water conservancy conditions are good.

af. The former is found in fairly high mountain and hill ridged alluvium, and the latter is shallow yashini soil where the catchment role is fairly slight.

Table 12. Statistical Analysis of Wetlands Soils

(a) 等级	(c) 土种	面 (o) 积 (p) 小计 (亩)	(q) 占稻田 (%)	(r) 养分含量 (s) 酸度 (盐度)	(t) 有机质 %	(u) 全量氮 N%	(v) 全量磷 P_2O_5%	(w) 全量钾 K_2O%	(x) 速效磷 斤/亩	(y) 速效钾 斤/亩	分 (z) 布
(b) 低产土壤	沙(d)田	2,306,025	5.36	7.5～7.7	1.210	0.196	0.117		4.4	37.1	河溪沿岸急流冲淤地和湖区溃堤倒垸处。 (aa) 如汉寿、会同、沅江。
				5.2～6.1	1.702	0.106	0.106	2.202	26.5	20.1	
	大眼红沙泥	(e) 149,595		4.7～7.3	1.719	0.117	0.090	2.235	16.3	46.3	丘陵、低山顶部，垅冲高排田，如衡南、郴县、耒阳、沅陵、黔阳、溆浦、零陵、芷江。 (ab)
	马干泥 大眼夹泥	(f) 30,925		5.7～7.5	2.155	0.148	0.086	2.188	5.7	30.2	衡阳、衡东、衡南、溆浦、泸溪、麻阳、辰溪等地 (ac)
	白胶泥	(g) 529,981	1.23	5.2～5.8	2.122	0.125	0.058	1.017	4.4	19.2	河谷平原较高地带、丘陵垅侧塘坝边较多。 (ad)
	白(h)泥	539,991	1.35								山丘二排田 (ae) 如自治州、衡阳、郴县
	黄夹泥	(i) 2,146,855	4.99	5.8～7.5	1.826	0.136	0.100	2.180	5.6	23.4	山丘岸田，二排田，台田。 (af) 如双峰、永兴、郴县
	黄泥水田	(j) 1,928,421	4.49	5.0～5.9	1.457	0.124	0.092	1.595	4.3	18.5	黄土地区的山脚和旱土相接处．水土流失区． (ag) 湘中、湘南、古丈、长沙、永顺
	岩渣子田	(k) 969,232	2.25	6.6	2.314	0.128	0.111	0.801	8.4	41.4	山区各县、郴、黔、邵、自治州 坡地梯田、山谷槽田、高冲，小垅尾部．辰溪． (ah)
	冷浸田	(l) 2,971,049	6.89	5.0～7.4	3.472	0.189	0.061	1.952	4.0	34.4	山丘狭窄冲垅低洼处，塘坝高塘脚下河谷低处．如道县、永兴、汝、桂、黔阳、邵阳 (ai)
	深脚夹鸭屎泥	(m) 3,570,375	8.3	5.6～7.3	2.886	0.179	0.062	2.294	4.1	16.8	
				5.6～7.8	3.397	0.188	0.100	2.104	6.1	30.7	冲垅较低部位． (aj) 溆、衡、新化、湘乡、宜、宋、益
(n)	合计	15,142,449	35.3								(ak) 青夹泥共6549402亩占稻田的15.23%

[Key on following page]

Key:

a. Category
b. Low yield soils
c. Kind
d. Sandy soil
e. Dayan [large pore] sandy hongni
f. Maganni and intercalated dayanni [large pore soil]
g. Baijiaoni
h. Baini
i. Intercalated huangni
j. Huangni wetlands
k. Rock debris fields
l. Cold waterlogged fields
m. Deep intercalated yashini soil
n. Total
o. Area
p. Subtotal (mu)
q. Percentage of paddyfields
r. Nutrient content
s. Acidity (salinity)
t. Percentage of organic matter
u. Percentage of total nitrate
v. Percentage of total phosphate P_2O_5
w. Percentage of total potash K_2O
x. Quick acting phosphate (jin per mu)
y. Quick acting potash (jin per mu)
z. Distribution
aa. In areas of rapid flow silting along the shores of streams, and in lake regions where flood waters on lowlying land are lifted to protective embankments, as at Hanshou, Huitong, and Yuanjiang.
ab. On tops of hills and low mountains, and on ridges of high paitian as at Hengnan, Chenxian, Laiyang, Yuanling, Qianyang, Shupu, Lingling, and Zhijiang.
ac. Hengyang, Hengdong, Hengnan, Shupu, Huxi, Mayang, and Chenxi.
ad. Higher areas of river valleys and plains; substantial amounts below hills and dammed ponds.
ae. Erpaitian on hills as in the autonomous zhou, at Hengyang and in Chenxian.
af. Shore fields in hills, erpaitian, and uplifted fields as at Shuangfeng, Yongxing, and Chenxian.
ag. At places where mountain foothills and drylands meet in yellow soil areas, and in eroded areas. Central Hunan, southern Hunan, Guzhang, Changsha, and Yongshun.
ah. In all mountain area counties, in Chenzhou, Qianyang and Shaoyang prefectures, in the autonomous zhou, in terraced fields on slopes, in valley trough fields, in gaochong [7559 5897] and the ends of small ridges, and in Chenxi.
ai. In long narrow abraded ridge [5897 1096] lowlying places and in low places in river valleys at the foot of dams and high cliffs as in Daoxian, Yongxing, Rucheng, Guidong, Qianyang, and Shaoyang counties.
aj. On relative low parts of ridges, in Shupu, Hengyang, Xinhua, Xiangxiang, Yizhang, Laiyang, and Yiyang counties.
ak. Intercalated qingni totals 6,549,402 mu, or 15.23 percent of paddyfields.

Low yield field soils in the province may be divided into two general categories. One is cold, wet, toxic paddyfields (such as cold waterlogged fields, muddy fields, deep yashini fields, and ore poisoned fields). In addition are sandy and clayey infertile paddyfields (such as heavy sand fields, intercalated huangni soil and intercalated baini soil). One factor or possibly several factors may cause low yield fields. For category I wetlands, generally improvement methods include the draining of waterlogging and elimination of toxins, bringing in of soil from elsewhere and mixing in of sand, removal of water to sun the fields, growing of green manure in winter, and fertilization with phosphate. For category II fields, methods include turning in of soil brought from elsewhere, growing of green manure, and increased fertilization with organic fertilizer and phosphate fertilizer for gradual improvement in physical properties and fertility.

In Hunan Province, red soil and yellow soil account for 50-60 percent of the total soil area. Red soil is found mostly in the hills and basins to the east of Xuefeng Shan, and yellow soil is found mostly in mountain regions. Red and yellow soil wastelands and drylands are composed mostly of red (and yellow) soils containing rock debris, dead loess, loess, mature loess, yellow sandy soil, and rock debris soil. Once mature yellow soil and yellow sandy soil have been improved, the mature layer is thick, and soil cultivatability and structure are good; nutrient content is fairly high, and the soil becomes a high yield dryland soil. (Table 13) Most dryland red soil has a pH of less than 5.5 and an organic content as low as 1 percent. It is deficient in nitrogen, phosphate, and potash; its structure is poor; and its capacity for storing and retaining water is weak. In addition, much of it is on farmed hillsides, which are fairly universally acidic, infertile, leather, dry, and scoured. Red and yellow dryland soils account for more than 80 percent of the province's total soil area. They require all-around planning, comprehensive use, and active improvement.

2. General Statement on Types of Plant Cover and Forest Resources

Hunan Province is located in the center of the sub-tropical broadleaf evergreen region where water and heat resources are abundant, where the area is vast, and where mountains and hills rise and fall. As a result, types of vegetation are fairly numerous and plant communities intermingled. There are more than 5,000 plant varieties in the whole province, which is more than one-seventh the total for the country as a whole.

(1) Types of Plant Cover

Zonal plant cover within the province consists of broadleaf evergreen forests, deciduous leaf-broadleaf evergreen forests, and sub-tropical coniferous forests and bamboo forests as representative types. There are variations from one region to another as a result of latitude, topography, and water and heat conditions. A look at horizontal distribution shows a considerable number of tropical broadleaf evergreen forests in southern Hunan close to the South Asia tropical zone, including woody varieties such as southern thick husk cassia [0624 3011 2710], Nanling evergreen chinquapin, lujiaokao [7773 6037 2723], red cassia tree, hushili [5170

Table 13. Area by Area Statistical Table Showing Dryland Soil Fertility

	(a) 高产土壤			(b) 中产土壤			(c) 低产土壤		
	土(d)种	面(e)积	%	土(d)种	面(e)积	%	土(d)种	面(e)积	%
(f)	黑沙土	725,575	5.53	河(l)沙土	1,253,555		岩(q)渣子土	606,197	4.62
(g)	黑黄土	419,130	3.19	火(m)石土	320;325	2.44	扁(r)沙土	149,898	1.14
(h)	潮沙土	529,742	3.83	大(n)眼土	375,909	2.86	粗(s)沙土	59,931	
(i)	泥夹沙土	1,228,957	9.36	黄(o)土	2,662,299	20.27	死(t)黄土	1,451,284	11.05
(j)	熟黄土	1,420,271	10.82	黄(p)沙土	999,142	7.61	白(u)夹泥	146,728	1.12
							马(v)肝土	60,732	0.46
							红(w)沙土	392,043	2.98
							白(x)沙土	320,597	2.44
(k)	合计	4,323,405			5,611,230			3,187,410	
	%	32.9			42.7			24.4	

Key:

a. High yield soils
b. Intermediate yield soils
c. Low yield soils
d. Kind of soil
e. Area
f. Black sandy soil
g. Black loess
h. Sandy chao soil
i. Intercalated sand and soil
j. Mature loess
k. Total
l. River silt
m. Flint soil
n. Dayan [large pore] soil
o. Loess
p. Sandy loess
q. Rock debris soil
r. Slightly sandy soil
s. Coarse sand soil
t. Dead loess
u. White intercalated soil
v. Magan soil
w. Red sandy soil
x. White sandy soil

3044 2929], myrtle, and Rangoon creeper. Caulifloria and flare of roots has also been found. Moving northward slowly, natural plant cover found in central and eastern Hunan predominantly consists of Castanopsis sclerophylla, Quercus glauca and members of the evergreen chinquapin family. Masson pine, tea oil plants, azaleas, and tiemangqi [6993 5345 5487] form a classic central sub-tropical hill type masson pine forest community. Though caulifloria has not been found in central Hunan and in the Xuefeng mountain and hill region, there is some embryonic root flaring. In the hills around the lakes of northern Hunan, deciduous varieties such as white oak [Quercus alba], small leaf li ji mu [1420 5509 2929 2606 4949 2606 Loropetalum chinense], black dye trees [Platycaria strobilacea], Chinese sweet gum [Liquidambar taiwaniana], dentate oak [Quercus dentata], and yellow sandalwood [Salbergia hupeana] predominate. Castonopsis sclerophylla and Quercus glauca occur here only in valleys on the leeward side of mountains. Mixed forests of evergreens and deciduous broadleaf trees form a transition from the central sub-tropical zone to the northern sub-tropical zone. The same is pretty much true of the Xuefeng mountain region of western Hunan, and of the northwestern, central, and eastern regions of the province. However, in southwestern Hunan, some tree species from south China, eastern Guizhou Province and northern Guangxi Province intrude as, for example, South China evergreen chinquapin, luofu chinquapin [5012 3187 2723], monocoque cassia [4289 3011 2710], and Hunan mountain walnut. Because of the numerous mountains in northwestern Hunan and its location slightly northward, temperate zone varieties are fairly numerous, second only to those found in the lake region of northern Hunan. Many varieties from Sichuan, Hubei, and Guizong are found here, as well as relic plants or rare tree varieties such as metasequoia [Metasequoia glyptostroboides], Emmenopteris henryi, Davidia involucrata, and maohongzhuang [3029 4767 2866]. The foregoing substantially reflect that the province's botanical sub-system follows zones of latitude and follows a pattern of gradual transition from south to north. A look at vertical distribution of plant cover shows altitude distribution of broadleaf evergreen forests to decrease gradually with latitude from south to north. For example, on Mang Shan (whose main peak, Shikengkong, is at an altitude of 1,902 meters) in southern Hunan, broadleaf evergreens are found at an altitude of 1,200 meters above sea level. Moving northward to the Xuefeng Shan range (whose main peak, Luowengbamian Shan, is at an altitude of 1,934 meters above sea level), they occur up to 1,000 meters. Farther north to the Wuling Shan region (where Badagong Shan is 1,820 meters above sea level), they drop down to 800 meters. In the Hunan central hill region, a part of the Nanyue system (at 1,290 meters above sea level), broadleaf evergreen forests on Gu Shan, which is influenced by cold currents, are found at only above 700 meters above sea level. (Table 14)

As a result of human activities over the years, most of the forest cover in the province today is secondary growth. The principal types of plant cover are as follows:

(1) Broadleaf evergreen forests: Such forests should be the classic zonal plant cover found everywhere in the province at the proper altitude above sea level, but today only small numbers of remnants survive in remote mountainlands. These are major headwater forests and timber forests supplying wood for farm implements and for special purposes.

Table 14. Vertical Distribution of Plant Cover on Mang Shan, Heng Shan, and Xuefeng Shan

(a) 高度(米) / (e) 垂直带谱	(b) 莽山	(c) 衡山(南岳)	(d) 雪峰山(罗翁八面山)
(f) 山顶灌丛及草甸	1800—1929	1100—1290	1500—1934
(g) 针叶阔叶混交林	1400—1800	800—1100	1250(云山)(j) - 1500
(h) 常绿、落叶阔叶混交林	1200—1400	600—800	1000—1250(云山)(j)
(i) 常绿阔叶林	400—1200	600(现状松杉)(k)	400—1000(现状松、杉、竹等)(l)

Key:

a. Elevation (meters)
b. Mang Shan
c. Heng Shan (southern hills)
d. Xuefeng Shan (Luowengbamian Shan)
e. Survey of vertical bands
f. Mountaintop shrubs and meadow grass
g. Mixed coniferous and deciduous forests
h. Mixed evergreen and broadleaf deciduous forests
i. Broadleaf evergreen forests
j. Yun Shan
k. Currently pine and fir
l. Currently pine, fir, and bamboo

(2) Coniferous tree forests: The masson pine forests and fir tree forests found everywhere in the province are large man-made or semi-man-made. Second are small numbers of cypress forests in limestone rock areas. Both are important timber forests.

(3) Mixed evergreen and broadleaf deciduous forests: Such forests are found in mountainlands, hill regions and limestone rock low mountain areas at proper elevation above sea level, and are made up of headwater forests, timber forests, and woody plant food forests.

(4) Mixed coniferous and broadleaf forests: These are usually mixed forests containing masson pine, Chinese fir, and miscellaneous trees, or with growth of moso bamboo as well. Such forests are un unstable transitional community. However, at certain elevations, they constitute fairly stable communities.

(5) Economic forests: Tung trees are a small deciduous shrub and a sun-loving specie found mostly at below 1,000 meters above sea level in well drained, neutral or slightly alkaline soil areas. They are concentrated in northwestern Hunan. Tea oil plants are a small evergreen shrub found in fairly large numbers in red soil low mountain and hill regions of southern Hunan.

(6) Bamboo forests: Such forests contain mostly moso bamboo and are found in the hill and mountainlands to the east of Xuefeng Shan. They are important timber forests and provide raw materials for paper manufacture. Most are man-made or semi-man-made, and contain a mixture of evergreen and deciduous tree species.

(7) Wasteland scrub and grassy slopes: Most such areas have resulted from frequent destruction of forest plant cover and are extremely unstable.

(8) Hydrophyte and aquatic plant colonies: These are found in lowlying, wet lake regions and consist mostly of common reeds, reeds [ampholis yedoensis], and water chestnuts.

(2) Forest Resources

Hunan Province has about 2,000 kinds of woody seed plants including about 800 kinds of bushes (including small shrubs) and more than 500 kinds of useful timber trees. Species vie with one another, the cinnamomum camphora family being dominant followed by the sladeniae, orchidaceae, the ilex family, the rose family, and the shanji [1472 4335] family, all of which are fairly widespread. There are more than 40 kinds of bamboo, the dominant one being Japanese timber bamboo [Phyllostachys bambusoides], with moso bamboo output holding an important position. Rare trees consist of more than 40 species including bud-bearing Chinese hemlock [7022 5383 6993 2619], Chinese hemlock [Tsuga chinensis], Guangdong pine, Hunan oak [Quercus silva], Yunshan linden, Hunan linden, Yunshan baili [0184 2867 0184 2867], and Hunan tea oil trees. An inventory of forest resources done in 1976 shows the province to have a 109,055,400 mu forest area, or about 58 percent of the total land used for forestry, and forest reserves totaling 187.71 million cubic meters. The overall forest resources situation may be characterized as follows:

(1) Few natural forests and a large proportion of secondary growth forests and man-made forests, forest resources being fairly slight overall. For historical reasons, zonal broadleaf evergreen forests amount to less than 10 percent of the province's forest area. Primeval forests, in particular, are very rare. At the present time, such forests are found at scattered sites at mid-level and atop Mang Shan in Yizhang County, on Badagong Shan in Sangzhi County, at Zhangjiajie in Dayong County, at Xiaoxi in Yongshun County, on Ziyun Shan and Shunhuang Shan in Xinning County, on Lianyun Shan in Pingjiang County, on Dawei Shan in Liuyang County, at Gaozeyuan in Jiangyong County, and on Yangming Shan and Heng Shan in Shuangpai County. This is an approximately 1 million mu area and is only about 0.32 percent of the province's total forest area.

Coniferous forests make up most of the forested area, account for most of the forest reserves, and are the forests that are mostly felled in the province. They account for somewhat more than 55 percent of the province's forested area (Table 15). Masson pine accounts for half the province's timber forest area and for more than 43 percent of forest reserves, and masson pine forests have developed mostly from airborne seeds. Chinese fir

accounts for 37.6 percent of the province's timber forest area and for 31.5 percent of its reserves. There are both secondary growth and afforested Chinese fir forests. Cuttings have been taken from the "Yao [3852] fir" of Jianghua County, a long-famed "East Lake wood," and seedlings of "guangmu" [1684 2606], a "West Lake wood," have been planted; thus experience and proper environmental conditions for the growing of fine quality fir are had.

Table 15. Statistics on Timber Forest Area and Reserves of Dominant Tree Varieties

(a) 项目	(d)杉木		(e)马尾松		(f)阔叶林		(g)柏木		合 (h) 计	
	面(i)积	蓄(j)积	面(i)积	蓄(j)积	面(i)积	蓄(j)积	面(i)积	蓄(j)积	面(i)积	蓄(j)积
(b) 数量	2544.19	4644.27	3358.2	6431.4	840.12	3645.7	30.42	44.32	6773	14765.6
(c) 所占比重 (%)	37.6	31.5	49.6	43.5	12.4	24.7	0.4	0.3		

Key:

a. Particulars
b. Amount
c. Percentage of total
d. Chinese fir
e. Masson pine
f. Broadleaf forests
g. Cypress
h. Total
i. Area
j. Reserves

In addition to timber forests, economic forests such as tea oil, tung tree, and moso bamboo hold a definite position. Economic forest area totals 30,984,800 mu, or 28.41 percent of the province's forested area. Tea oil trees account for 69.41 percent of economic forests; tung trees for 10.94 percent, and tea plants for 12.45 percent, all of them holding important positions in China. The bamboo forest area totals 8,473,700 mu with a total of 891,728,900 stalks of bamboo, 95.7 percent of the area and 73.3 percent of the number of bamboo stalks being moso bamboo. Hunan is one of the provinces in which moso bamboo is found fairly widely.

Hunan Province has 187.7 billion cubic meters of standing timber reserves. This is only 1.9 percent of total forest resources for China as a whole, Hunan ranking 12th among 30 provinces and municipalities (including Taiwan). Timber reserves average 3.1 cubic meters per capita, 6.2 cubic meters lower than the national average. Hunan has 1.95 mu per capita of forested area, less than in neighboring Jiangxi and Guangxi provinces.

(2) The area devoted to forestry is fairly large, but distribution of forest area is unbalanced. Hunan devotes 186,958,600 mu, or about 59 percent of its total area, to forestry. As a result of substantial differences in natural conditions from place to place, plus the effects of man's social activities over a long period of time, not only do regional differences exist in distribution of forests, but variations within regions are also even more striking. For example, timber forests are concentrated mostly in mountain regions of western, southern and eastern Hunan. Northwestern Hunan is a major economic forest area in the province for the production of tung oil, eucommia bark, Chinese chestnuts, Chinese tallow, and walnuts. Its

timber forests consist not only of Chinese fir, pine, and oak, but cypress is also fairly widespread. However, timber forest reserves for the 10 counties in the western Hunan autonomous zhou (15,008,500 cubic meters) are virtually equal only to the timber forest reserves of just Yuanling County alone (12,743,000 cubic meters). The forest zone in the middle and upper reaches of the Yuan Shui in southwestern Hunan accounts for 30 percent of the province's total timber reserves, and it has become one of the key Chinese fir production areas in the province. Hunan Province's southern mountainlands contain 25 percent of the province's forest reserves. Various kinds of forest trees occur both over wide areas and in relatively concentrated areas. This includes Chinese fir and moso bamboo, which are concentrated in the mountain ranges of the western part of the province, and masson pine and broadleaf forests, which are concentrated in the southeastern mountain region. The mountainlands of eastern Hunan were old revolutionary bases during the period of the Great Revolution, and forest resources here have sustained serious damage from the Kuomintang. A mixture of all sorts of forest trees and bushes grow here, and the forests present a picture of extremely uneven growth. Timber output per unit of area is low. The red soil hill area of most parts of central Hunan and everywhere in neighboring mountains has been the site of frequent socioeconomic activity, and forest cover was destroyed fairly early. Except for some Chinese fir and moso bamboo forests, an overwhelming majority of areas contain sparse masson pine woodlands, and tea oil and tea plants are found in fairly concentrated areas. Forest trees on plains around lakes are found mostly in shelter forests today. Vestigial natural second growth deciduous forests in hill regions around lakes consist mostly of cold tolerant tree species in mixed forests spotted here and there. Other growth consists of sparse masson pine forests and tea plants planted by man.

(3) Amount of cutting outstrips amount of growth, and forestland yields per unit of area are low. Statistics show that in the 15 years from 1950-1964, output of timber averaged 2,074,000 cubic meters per year, and commodity output of nan [2809] bamboo totaled 9,864,000 stalks. If timber used by the masses is added to annual state plan fellings, a total of 5 million cubic meters must be felled. However, figuring a growth rate for reserves of 3 percent annually, only 4.5 million cubic meters can be grown each year; thus the amount of felling outstrips the amount of growth. Furthermore, an area of about 2.5 million mu is felled annually, and this is very much more than the afforested preserve area. A look at the age of existing forestlands shows reserves in intermediate and young forests to be about equal to reserves in mature forests; however, 84 percent of all forests are intermediate and young forests, while only 16 percent are mature forests, so there is a great gap between the two. Table 16 shows that the amount of felling in forest areas near water and near roads is greater than in remote areas. In most places, replanting lags behind felling. Furthermore, current forestlands average reserves of 2.13 cubic meters per mu, which is only 40 percent of the natural average of 5.27 cubic meters per mu, placing Hunan in 20th place in the country.

Table 16. Age Structure of Timber Forests

Area: 10,000 mu
Reserves: 10,000 cubic meters

(a) 活立木总蓄积	(b) 有林地各龄组面积、蓄积								(g) 疏林蓄积	(h) 散生木蓄积
	合 (c) 计		(d) 幼龄林		(e) 中龄林		(f) 成熟林			
	面 (i) 积	蓄 (j) 积	面 (i) 积	蓄 (j) 积	面 (i) 积	蓄 (j) 积	面 (i) 积	蓄 (j) 积		
18772	6918.39	14987.25	4559.61	2734.1	1272.48	4760.03	1086.31	7493.12	2447.49	1337.0
%	100	100	65.4	17.6	18.6	32.1	16.0	50.3		

Key:

a. Total standing reserves
b. Area and reserves of forestland at various ages
c. Total
d. Young forests
e. Middle aged forests
f. Mature forests
g. Sparse forest reserves
h. Timber reserves growing in dispersed places
i. Area
j. Reserves

(3) Wild Plant Resources

Hunan Province has about 1,000 species of wild plants of economic value. Species and reserves vary in concentration and dispersal as environmental conditions change from south to north, and from mountains to hills to plains. Species are numerous; they are used in many ways; and they occur over wide areas.

(1) Medicinal plants. There are about 800 varieties of medicinal plants. More than 100 species of frequently used medicines and important herbs are purchased by the state. Most famous ones are rhizome of Chinese goldthread [Coptis chinensis], tuber of elevated gastrodia [Gastrodia elata], stem of noble dendrobium [Dendrobium nobile], bark of official magnolia [Magnolia officinalis], Astraotylis Lancea Formalyrata, huangpi [7806 4122], bark of eucommia [Eucommia ulmoides], wuyu [0702 5505], root of purple-flowered peucedanum [Peucedanum decursivum], and bulb of frittilary [Fritillaria thunbergii]. Surveys have shown the Mang Shan region to be rich in more than 200 species of Chinese medicinal herbs. Large amounts of official magnolia and huangpi are grown in Jianghua, and a considerable amount of noble dendrobium, mountain dangshen [Codonopsis pilosula], Chinese yam, Chinese angelica, and sealwort [Polygonatum sibiricum] grows there. Medicinal herbs produced on Badagong Shan in Sangzhi County in northwestern Hunan include tuber of elevated gastrodia, rhizome of Chinese goldthread, southern Chinese magnoliavine fruit [Schisandra chinensis], Chinese mahonia [Mahonia fortunei], bark of eucommia, rhizome of chuanxiong [Ligusticum wallichii], Astraotylis Lancea Formalyrata, dangshan, and polygonatum. More than 100 varieties of these herbs grow wild or are cultivated. The scrub and grasslands of the Mufu-Lianyun mountainlands contain tracts of medicinal plants such as rhizome of chuanxiong, tuber of hyacinth bletilla

[Bletilla striata], root of purple-flowered peucedanum, and the rather high priced Evodia Rutaedarpa. The sealwort, daxueteng [1129 5877 5671], Chinese angelica, lillies, and Paris polyphylla produced in Nanyue County are also famed far and wide.

(2) Starch plants. There are an estimated more than 60 species of these plants from which sugar can be produced or that are used for the fermentation of alcoholic beverages. They include members of the Fagaceae family and of the Chinquapin family, of the Quercus family, and of the chestnut family as well as of other families, and include wild oats, wild water chestnuts, gingko fruit, fruit of Cherokee rose [Rosa laevigata], wild Chinese hawthorn, ground loquats, wild persimmons, and red bayberry [Myrica rubra] to a total of more than 40 species. There are more than 20 species of plants in which the portion below ground contains starch such as Chinese chestnuts, lillies, brake ferns, tuber of multiflower knotweed [polygonum multiflorum] and geteng [5514 5671].

(3) Aromatic oil and tannin plants. These include more than 20 species of aromatic oil plants such as the fruit of the cubeb litsea tree [Litsea cubeba], zingiber [Zingiber officinalis], camphor trees, phoebe nanmu trees, bark of official magnolia, masson pines, cypresses, oranges, tangerines, pomelos (pomelo skins), artemesia, peppermint, wild lemongrass, and rhizome of nutgrass flatsedge [Cyperus rotundus]. Tannin plants, the roots of which are gathered, such as small fruit wild rose, and fruit of Cherokee rose [Rose laevigata]; the barks of which are gathered including masson pine, Chinese hemlock, red bayberry [Myrica rubra], Mongolian oak [Quercus dentata], members of the Castanea family, and beech trees; and the fruits of which are gathered such as wild kaki persimmons [Diospyros kaki, var. silvestris], and Caesalpinia digyno. There are also more than 40 kinds of fruits and fruit skins that may be used such as mountain walnuts. All the foregoing plants are raw materials for the chemical industry.

(4) Fiber plants. Plants in this category of fairly high economic value include reeds, which grow virtually everywhere in northern Hunan and in shallows around lakes. They are found in 12 counties (or municipalities) in lake regions over an area of 896,200 mu. Current output is 565,400 tons, 88 percent of which is used for the manufacture of paper. They are a first rate raw material for the manufacture of paper, having a high pulp rate and white color. Their roots and stems may be used for medicines; their inflorescence may be used for brooms; their flowers may be used in cushions and pillows; and their stalks and stems may be used as thatch, and for the weaving of curtains, mats, and baskets. They are also a fine material used to strengthen dikes against high water. In addition, Chinese parasol tree bark and piemarker may be used to make twine, and wanhua [5451 5363] (or dimianpi [0866 2258 4122]), and Nanling wanhua are high quality materials for the making of paper.

Chapter 2. History, Present Status and Development of Agriculture

Third Section. Present Status and Patterns of Agricultural Production

As the result of the intermixture of natural conditions, socioeconomic factors, and historical development, Hunan Province's agricultural production has come to have the following characteristics in terms of land use, geographic distribution, and structure and development of individual sectors.

1. Relatively Scant Cultivated Land and Vast Amounts of Land Usable for Forests

Apart from the 23.64 percent of the 317.7 million mu of land in the province used for other purposes (including for cities and towns, residential sites, industrial plants and mines, roads, streams, lakes, the shallows of bodies of water, and rocky mountains), plus 1.25 percent of water surfaces used for breeding, 75.11 percent is used for farming and forestry (Table 17). This includes 58.83 percent used for forestry and 16.28 percent used for farming, or an average of about 4 mu per capita of agricultural population used for forestry, and only around 1 mu per capita used for farming.

I. Cultivated Land Use

First, the topography is complex and the land reclamation index is not high. For the province as a whole, the reclamation index averages around 16 percent; in northern Hunan it is 28.1 percent, including more than 60 percent for the lake region. In central Hunan, it is 21 percent, including 30 percent in the Changsha-Hengyang Basin. In southern and western Hunan it is 13 and 10.8 percent respectively, including between 15 and 21 percent for flat and gently sloping places. Thus, northern Hunan stands first in the extent of development and use of cultivated land (Table 18) followed by central Hunan, southern Hunan, and western Hunan in that order.

Second, the far greater percentage of wetlands to drylands is a common feature of the way of using cultivated land throughout the province. Wetlands and drylands constitute 78.2 and 21.8 percent of the province's total cultivated land area. In terms of region, central and northern Hunan have the highest percentage of wetlands in the province while western and northern Hunan have a high proportion of the province's drylands. However, the

drylands of the western part of the province produce mostly grain, while the drylands of the northern part of the province are devoted mostly to development of cash crops.

Table 17. Structure of the Whole Province's Land Area (1977)

		(a) 土地类别	(b) 面积 (万亩)	(c) 比例 (%)
(d)		总计	31777.35	100
(e)		1. 耕地	5172.81	16.28
(f)	其中	水 (g) 田	4049.29	12.74
		旱 (h) 土	1123.52	3.54
(i)		2. 林业用地	18695.86	58.83
(f)	其中	有 (j) 林地	10905.54	34.32
		疏、灌木林及未成林造林地 (k)	2763.57	8.7
		荒 (l) 山迹地	5026.75	15.82
(m)		3. 水面	2030.64	6.39
(n)		4. 其他	5878.04	18.5

Key:

a. Kind of land
b. Area (10,000 mu)
c. Percentage
d. Grand total
e. 1. Cultivated land
f. Including:
g. Wetlands
h. Drylands
i. 2. Land used for forestry
j. Forested land
k. Sparsely forested, scrub forests, and immature forest afforested land
l. Barren mountain slash areas
m. 3. Water surfaces
n. 4. Other

Third, the amount of cultivated land decreases with each passing year, and the average per capita area is not great. In 1950, the province had 51.36 million mu of cultivated land, and in 1957 it reached a high point of 58.03 million mu. During the 1960's, the amount remained at around 54 million mu, but since the 1970's, it has been around 52 million mu each year. The average amount of cultivated land per capita of agricultural population in the province was 1.8 mu in 1957, and about 1.16 mu in 1975. This included 1.44 mu per capita in northern Hunan, 1.18 mu in western Hunan, and 1.11 mu in southern Hunan. In densely populated central Hunan, it was 1.01 mu, with the degree of intensivity of farming being greatest in central Hunan.

Table 18. Percentage of Cultivated Land Utilization for Individual Regions of the Province (1979)

	(a) 分 区	(f) 占全省土地总面积(%)	(g) 占全省耕地总面积(%)	(h) 水田		(i) 旱土	
				占全省水田面积 (j) (%)	占本区耕地面积 (k) (%)	占全省旱土面积 (1) (%)	占本区耕地面积 (m) (%)
(b)	湘 北	14.26	24.64	23.64	75.00	28.23	25.00
(c)	湘 中	25.16	32.12	34.38	83.69	24.01	16.31
(d)	湘 南	22.91	18.10	18.75	80.98	15.78	19.02
(e)	湘 西	37.67	25.14	23.23	72.23	31.98	27.77

Key:
- a. Region
- b. Northern Hunan
- c. Central Hunan
- d. Southern Hunan
- e. Western Hunan
- f. Percentage of total land area in the province
- g. Percentage of total cultivated land area in the province
- h. Wetlands
- i. Drylands
- j. Percentage of wetland area in the province
- k. Percent of cultivated land in the region
- 1. Percentage of dryland area in the province
- m. Percentage of cultivated land in the province

Fourth, the farming system is fairly complex, and the multiple cropping index fairly high. This is both a reflection of the extent of use of natural resources in the province, and also a prominent manifestation of land use. The province's paddyfield farming system may currently be placed in two categories as follows:

(1) A farming system of predominantly two crops of rice. This is a system of one dryland and two wetland crops, i.e., a dryland crop in winter, and two paddy rice crops in summer, two or three crops being grown each year. This system is found in both new and old rice growing areas, and the following several crop rotation systems are used for the most part:

a) The rice-rice-green manure system: This system grows two crops of paddy and one crop of Chinese milk vetch. This is an important farming system that is most widespread, that uses the land to nurture the land, and that raises grain yields per unit of area and gross output. In most years, it is used on 30 million mu throughout the province, which is about 75 percent of the total paddyfield area.

b) Three crop system of rice-rice-oil-bearing crop: This is a fine system that is able to make use of the growing period during all four seasons, that takes account of both grain and oil, and combines soil use with soil nurture. It is used on more than 4 million mu in the province, or about 10 percent of paddyland.

c) Three crop system of rice-rice-wheat: This entails the planting of wheat after two crops of paddy. It is currently practicable only on a small area possessing fine production conditions.

The double or triple crop system in Hunan Province is fairly widespread east of Xuefeng Shan and north of Yangming Shan. Double cropping of rice is least in northwestern Hunan. (See Table 22)

(2) The predominantly single crop of paddy farming system. This system is used on about 20 percent of the province's paddyfield area, where it is used in the following several ways:

Rice-green manure-rice-oil-bearing crop farming system: This means that following a summer crop of intermediate rice or a single crop of late rice, Chinese milk vetch and rapeseed or barley and wheat are grown in winter. In areas where a single crop of paddy predominates, green manure is grown in winter to provide ample organic material for the paddy during the following year. Winter growing of barley and wheat or rapeseed helps raise oil-bearing crop and grain outputs. Currently a small number of places still practice the growing of a single crop of paddy and the flooding of fields with water during winter.

Of the foregoing two farming systems, the former saw great development following liberation, and has become a mainstay of Hunan Province's paddy-field farming system.

Most places grow two dryland grain crops each year. Places in western Hunan have blazed a new trail of "three crops in two seasons"; i.e., a crop of spring grain and a crop of summer corn intercropped with sweet potatoes (or else two crops of gaoliang). In view of differences in crop characteristics and natural conditions, in addition to the use of major forms such as the growing of spring grain, and the intercropping of summer corn with sweet potatoes, some fairly high and cold mountain regions with infertile soil have begun to grow potatoes intercropped with corn, and to practice the growing of spring grain with the intercropping of corn and soybeans in the matching up of crops.

Accompanying the need for development of the people's production and livelihood, and gradual improvement in production conditions has been a stage-by-stage improvement in the multiple cropping index. In 1950, the index averaged 171.4 percent; in the 1960's, it was 197.1 percent; and during the 1970's, it was 234 percent. In 1979, the multiple cropping index for the whole province was 242 percent. Broken down by region, it was 254 percent for central Hunan, 259 percent for northern Hunan, 221 percent for southern Hunan, and 220 percent for western Hunan.

II. Use of Land for Forestry

Hunan Province currently uses 186,958,600 mu, or 58.8 percent of its total land area, for forestry. This land is found in places that are just the opposite of cultivated land areas, increasing from the north central hill basins toward the surrounding mountain areas. (Table 19)

Table 19. Percentage of Forestland, Forest Reserves, and Cover Rate for the Province

	(a) 林地面积	(b) 木材蓄积量	(c) 森林覆被率
(d) 全省	100	100	32.63
(e) 湘北	8.07	2.24	18.95
(f) 湘中	25.7	9.35	33.72
(g) 湘南	27.34	27.22	45.3
(h) 湘西	38.67	60.27	41.91

Key:

a. Forestland area
b. Timber reserves
c. Forest cover rate
d. Province as a whole
e. Northern Hunan
f. Central Hunan
g. Southern Hunan
h. Western Hunan

The forested area covers 109,055,400 mu, or 58.33 percent of the land used for forestry. Timber forests cover 67,729,300 mu or 62.1 percent of the area and account for the largest proportion. Half of these forests are masson pine, with Chinese fir holding second place. Economic forests cover 30,985,000 mu, or 28.41 percent of the total. More than three-fourths of this area is taken up by tea oil, tung oil and tea accounting for one-seventh of the total area. Bamboo forests cover 8,473,700 mu or 7.78 percent of the total. Moso bamboo predominates. The rest of the area is taken up by firewood forests, shelter forests, and special purpose forests. (Table 20)

Sparse forests, scrub forests and immature forests on afforested land also use 14.77 percent of the land devoted to forestry in the province, and barren slash land accounts for 26.9 percent. In addition, there are blank areas in the four besides [beside roads, streams, villages, and houses] awaiting the planting of trees. Thus, the task of managing forests, protecting forests, and greening of barren mountains in the province is a very large one.

III. Use of Water Surfaces

Hunan Province has 20,306,400 mu of freshwater surfaces such as rivers, lakes, reservoirs, and ponds accounting for 6.4 percent of the total land area in the province. The percentage is smallest, and it is mostly concentrated in the Dongting Hu area.

Rivers account for 9,635,000 mu or 47.45 percent of the total water area; lakes cover 6.3 million mu (4.23 million mu of external lakes and 2.07 million mu of internal lakes), or 31.03 percent of the water area. Reservoirs cover 2.15 million mu or 10.58 percent, and ponds cover about 2,221,400 mu or 10.94 percent.

Table 20. Composition of Forests in Hunan Province (1977)

	林地类别 (a)	面积 (b) (万亩)	占有林地 (c) %
(d)	合计	10905.54	100
(e)	1.用材林	6772.93	62.1
(f)	其中：杉木	2544.19	23.32
(g)	马尾松	3358.20	30.89
(h)	阔叶树	840.12	7.7
(i)	柏木	30.42	0.27
(j)	2.防护林	27.53	0.25
(k)	3.经济林	3098.48	28.41
(l)	其中：油茶	2456.7	22.53
(m)	油桐	229.74	2.11
(n)	茶叶	261.29	2.40
(o)	果木	88.18	0.81
(p)	其它	62.57	0.57
(q)	4.竹林	847.37	7.78
(r)	其中 毛竹	811.01	7.43
(s)	5.薪炭林	152.61	1.39
(t)	6.特用林	6.62	0.06

Key:
a. Kinds of forestlands
b. Area (10,000 mu)
c. Percentage of forestland
d. Total
e. 1. Timber forests
f. Including: Chinese fir
g. Masson pine
h. Deciduous trees
i. Cypress
j. 2. Shelter forests
k. 3. Economic forests
l. Including: Tea oil
m. Tung
n. Tea
o. Fruit trees
p. Other
q. 4. Bamboo forests
r. Including: Moso bamboo
s. 5. Firewood forests
t. 6. Special purpose forests

In 1979, 3,972,900 mu of water surfaces was used for breeding, and 120,900 mu was used for the growing of lotus. This was 76.4 and 2.33 percent respectively of the 5.2 million mu area usable for breeding and growing. Usable water surfaces have yet to be used to the full.

2. Abundant Varieties of Resources and Numerous Kinds of Production

Hunan Province has fairly plentiful crop, tree, livestock and poultry, and aquatic product species, and is favorable for the introduction and

domestication of plants from the north and south. Numerous undertakings have been developed for some time in the growing and breeding sectors for diversified agricultural production. As a result of differences in conditions from place to place, there has been a tendency toward relative regional concentration of different varieties of resources and kinds of production, with a definite pattern to their distribution.

I. Grain Crops

A look at several historical years shows the area sown to grain crops as a percentage of total area sown to have been as follows: 84.9 percent in 1949, 81.61 percent in 1957, 78.49 percent in 1964, 70.62 percent in 1971, 69.43 percent in 1975, and 68.44 percent in 1979. The area sown to grain crops has been wide, their outputs great, output value high, and contributions large in the overall structure of all grain crops, and the basic position they hold in agriculture has been very apparent.

Grain crops consist of more than 18 different varieties including paddy rice, wheat, barley, oats, rye, buckwheat, sweet potatoes, potatoes, cassava, corn, gaoliang, chanzi [4717 3934 1131], millet, broad beans, peas, mung beans, cowpeas, and red beans, but the percentage of both area sown and output of paddy rice is greatest.

(I) Paddy rice. The growing of paddy rice has a long history, and today early, intermediate, and late crops of xian, geng, nonglutinous, glutinous, deep water and short stem rice are grown. Both conventional varieties and newly developed hybrid varieties of rice are bred as superior varieties. In terms of distribution, paddy rice is the major crop in an overwhelming majority of the province's counties, which have become major paddy rice production areas on the country.

According to 1979 statistics, the area sown to paddy throughout the province was 79 percent of the area sown to grain crops, and double cropped rice was planted in 76.65 percent of wetlands though the amount planted varied substantially from place to place. (Table 21)

The table shows most double crop paddy as having been grown around lake areas, followed by central Hunan and southern Hunan in that order. Least was grown in western and northwestern Hunan.

(II) Summer dryland grain crops are sweet potatoes for the most part, with more than 6 million mu being planted in most years. Next comes corn with the growing of about 3 million mu in most years. Since growth characteristics of these two crops differ, they are found in different places. Sweet potatoes tolerate dry weather and infertile soil fairly well, and they are very adaptable, so they are grown everywhere. Mostly, however, they are found where there is a large amount of dryland such as in all of the counties of Shaoyang Prefecture, which are fairly dry in summer and fall. The second largest sweet potato growing area is the counties of southern Hunan and in Liuyang and Pingjiang counties in northeastern Hunan. Corn likes wetness and abhors dryness; it is suited for growing in mountainlands

at an elevation of from 300 to 500 meters above sea level such as the Wuling mountain region as well as in Jianghua and Jiangyong counties in the Nanling mountain region, where production is fairly concentrated.

Table 21. Table Showing Percentage of Double Crop Rice Sown on Wetlands at Various Places in Hunan Province

(a) 地 区	(h) 县数 (市)	(i) 水田占耕地面积的%	(j) 双季稻面积占水田面积的%	(k) 稻谷播面占粮食总播面的%
(b) 长、潭、衡丘陵盆地	20	88.2	84.9	91.87
(c) 黔阳山丘盆地	12	84.1	49.0	79.5
(d) 零郴山丘盆地	21	79.8	58.8	78.7
(e) 岳、益、常丘陵平原	20	76.8	94.11	87.04
(f) 邵阳山丘盆地	14	73.5	79.8	78.51
(g) 湘西北山地(包括石门、慈利、安化)	13	62.7	30.8	56.34

Key:

a. Region
b. Changsha, Xiangtan, and Hengyang hills and basins
c. Qianyang mountains, hills, and basins
d. Lingling and Chenzhou mountains, hills, and basins
e. Yueyang, Yiyang, and Changde hills and plains
f. Shaoyang mountains, hills, and basins
g. Mountain regions of northwestern Hunan (including Shimen, Cili, and Anbei)
h. Number of counties (or municipalities)
i. Wetlands as a percentage of cultivated land area
j. Double crop rice area as a percentage of wetlands area
k. Area sown to paddy as a percentage of total area sown

(III) Winter season dryland grain crops: Such crops are mostly wheat and a small amount of barley, the harvest area totaling more than 5 million mu. Some is found in all regions, but mostly these crops are found in places such as Shaoyang Prefecture and western Hunan where there is a relatively large amount of dryland, with some production around the lakes and in Changde Prefecture. A certain amount is also grown in Yengyang and southern Hunan. More than 2 million mu are planted to broad beans and peas. Up until liberation, these crops were found mostly in northern Hunan counties, but they have gradually come to be grown southward.

Crop structure is shown in Table 22.

Table 22. Table Showing Area Sown to Various Crops in Hunan Province

	(a) 项 目	(b) 一九六五年 (d) 面 积(万亩)	(e) 占总播面%	(c) 一九七九年 (d) 面 积(万亩)	(e) 占总播面%
(f)	农作物总播种面积	10965.82	100	12501.65	100
(g)	一、粮 食 作 物	8318.12	75.86	8556.32	68.44
(h)	1.稻 谷	5738.44	52.33	6760.29	54.08
(i)	早 稻	1701.70	15.57	2974.93	23.80
(j)	中稻及一季稻	2447.72	22.32	693.03	5.54
(k)	双 季 晚 稻	1589.02	14.49	3092.33	24.74
(l)	2.小 麦	478.90	4.37	400.46	3.20
(m)	3.薯 类	671.63	6.12	596.81	4.77
(n)	4.杂 粮	1190.44	10.86	601.25	4.81
(o)	5.大 豆	238.71	2.18	197.51	1.58
(p)	二、经 济 作 物	642.03	5.85	960.83	7.69
(q)	1.棉 花	226.41	2.06	241.23	1.93
(r)	2.油 料	355.19	3.23	552.88	4.42
(s)	花 生	42.21	0.38	65.77	0.53
(t)	油 菜 籽	266.87	2.43	459.09	3.67
(u)	芝 麻	32.37	0.30	23.86	0.19
(v)	3.麻 类	18.77	0.17	27.36	0.22
(w)	黄 红 麻	4.76	0.04	14.06	0.11
(x)	苎 麻	14.01	0.13	13.80	0.11
(y)	4.糖 料 (甘蔗)	5.41	0.05	21.52	0.17
(z)	5.烟 叶	21.60	0.20	78.50	0.63
(aa)	烤 烟	4.85	0.05	62.94	0.50
(ab)	土 烟	16.75	0.15	15.56	0.13
(ac)	6.其它经济作物	14.65	0.13	38.84	0.31
(ad)	三、其 它 作 物	2005.67	18.29	2984.50	23.87

Key:

a. Particulars
b. 1965
c. 1979
d. Area (10,000 mu)
e. Percent of total area
f. Total area sown to farm crops

g. A. Grain crops
h. 1. Paddy rice
i. Dryland rice
j. Intermediate and single crop rice
k. Double crop late rice
l. 2. Wheat

m. 3. Tubers
n. 4. Grains other than rice and wheat
o. 5. Soybeans
p. B. Cash crops
q. 1. Cotton
r. 2. Oil-bearing crops
s. Peanuts
t. Rapeseed
u. Sesame seed
v. 3. Hemp
w. Jute and ambari hemp
x. Ramie
y. 4. Sugar crops (cane sugar)
z. 5. Tobacco
aa. Flue-cured tobacco
ab. Sun-cured tobacco
ac. 6. Other cash crops
ad. C. Other crops

II. Cash Crops

In Hunan Province, cash crops means oil-bearing crops (rapeseed, peanuts, and sesame), cotton, hemp (jute and ambari hemp, and ramie), sugarcane, and tobacco (flue-cured and sun-cured). The area sown to cash crops amounts to only about 7 percent of the total area planted to farm crops.

(I) Oil-bearing crops: This includes rape, peanuts, and sesame, the proportion of rape being greatest.

Hunan Province is one of the major rape growing areas in the Chang Jiang Basin. Rape is grown in every county, and for a long time numerous places have grown paddy rice and oil-bearing crops, or tuber crops and oil-bearing crops, or cotton and oil-bearing crops either one after the other or intercropped. In recent years, the three crop area planted to oil-bearing crops-rice-rice in Changde, Yiyang and Yueyang prefectures accounts for about 50 percent of the total area of the province using a similar three crop system. In 1979, 4,590,900 mu was sown to rape in the whole province as follows: Counties growing more than 50,000 to 100,000 mu arranged in descending order included Liuyang, Pingjiang, Yuanjiang, Shupu, Yiyang, Cili, Liling, Miluo, Huarong, Yuanling, Nanxian Dayong, Dongkou, Linli, Longhui, Anbei, Shimen, Xiangyin, Taojiang, Zhuzhou, Zhijiang, Linxiang, Wugang, and Hengdong. Those growing more than 100,000 mu arranged in descending order were Lixian, Changsha, Taoyuan, Youxian, Ningxiang, Xiangtan, Changde, Hengyang, Hanshou, Wangcheng, Hengnan, and Yueyang. Counties growing more than 50,000 mu totaled 36 and accounted for about 65 percent of the province's gross output of rapeseed. The general pattern of rape growing is generally in the lower reaches of the four rivers and in the lake region where little tea oil is produced. Moreover, the double crop rice area in these regions is also fairly concentrated, and a fairly close relationship exists between the growing of grain and oil-bearing crops that promotes the growing of both.

(II) Cotton: Hunan Province has a more than 300-year history in the growing of cotton. At the end of the 19th century, it began to meet the needs of China's textile industry, the expansion of plantings around the lakes taking the lead. As individual counties began to grow it on areas of varying size, production became dispersed and inconsistent. It was not until after liberation that vigorous efforts were made to revive and develop cotton growing. In 1979, 2,412,300 mu were sown to cotton, the area of

largest sowing being Li County where 240,000 mu was sown, followed by Taoyuan and Changde counties, each of which sowed 160,000 mu. Other counties growing between 80,000 and 110,000 mu were Huarong, Anxiang, Linli, Hanshou, and Cili. Counties growing between 50,000 and 70,000 mu were Nanxian, Shimen, Yueyang, Yuanjiang, Ningxiang, and Yiyang. Thus, counties planting an area of more than 50,000 mu numbered 14 for a total of 1,379,000 mu. Production of ginned cotton was 1,281,700 dan from 57.2 percent of the province's cottonfields and accounting for 68.4 percent of total output.

The foregoing makes clear that the province's cotton growing counties are mostly concentrated on tracts around the lakes of the northern part of the province and on the alluvial plains of the lower reaches of the Li Shui and Yuan Shui where yields are fairly high. Since cotton is a crop having deep roots and requiring cultivation between rows, and since it likes loose fertile soil and much sunlight, it thrives well on lake plains.

(III) Hemp (including ramie, jute, and ambari hemp): Hunan has a long history of growing ramie, and it is found pretty much everywhere in the province. "Yuan hemp" from northern Hunan enjoys a fine reputation, and fiber quality of "Jiagui hemp," and "Baijiao hemp" from southern Hunan is outstanding. The Pingjiang-Liuyang area of eastern Hunan uses ramie for superfine "summer cloth," which is noted far and wide. Dayong County in western Hunan has a good combination of hemp and tung (cake fertilizer). Historically 16 counties have been major producing areas, and ramie was produced everywhere in them, but Yuanjiang has taken first place in output producing about 60 percent of the province's total output in most years.

Inasmuch as ramie is a perennial plant that grows for many years, and that requires high temperatures and great humidity, windspeeds of below 5-force, and sandy soil, loam, or clayey loam during the period of its development, most hills and terraces of river valleys in Hunan Province are suitable for growing it. Here there is a pronounced alternation between wet and dry seasons; rainfall is copious during the early period of ramie development; yields per unit of area are fairly high, and the second and third crops of ramie are endangered by varying degrees of drought. Southern Hunan has abundant heat and a long effective growing season, suiting it to the growing of white foot ramie [4101 5183 5594] and elegant ramie [7161 5594]. In eastern Hunan the mountain ranges that parallel valleys break the wind; the valleys are fairly moist, and there are numerous kinds of soil. Northwestern Hunan is a green ramie growing area where humidity is fairly high, and where the effective growing season is somewhat longer than in northern or southwestern Hunan. In the ramie growing region of northern Hunan, the soil is fertile and moist, water is abundant, and the effect of the wind is fairly great, ramie fibers being spotted from much wind. Ramie varieties of fairly good quality include Bailiziqing, Luzhuqing, and Xiangzhu No 1.

Statistics show that in 1979 ramie was grown over a 138,000 mu area for a gross output of 257,200 dan, or an average 186 jin per mu. Fairly heavy producing areas were Yuanjiang, Nanxian, Hanshou, Yiyang, Chaling, Jiahe, Huarong, Youxian, Fenghuang, Dayong, Linxiang, Pingjiang, Xiangyin, Yizhang, Laiyang, Hengyang, Liuyang, Guiyang, and Luxi counties as well as Lixian

and Taoyuan counties, which accounted for 80.8 percent of the total ramie growing area in the province and 90.3 percent of gross output. The first six named counties alone accounted for 61.1 percent of the province's ramie farms and 75.6 percent of gross output, and Yuanjiang County alone grew 48,800 mu to produce 121,400 dan for first place in ramie production in the province.

The growing of jute and ambari hemp newly developed following liberation. These are annual, heat-loving crops that are able to tolerate flooding and withstand waterlogging, and are highly adaptable. They are suitable for growing around the edges of rivers and lakes, on embankments, and in hilly areas. In 1979, 140,600 mu of the province was planted to jute and ambari hemp, and gross output was 1,006,300 dan. Major producing areas were Nanxian, Huarong, Hanshou, and Huyin counties, which accounted for 82.57 percent of the jute and ambari hemp growing area and for 88.89 percent of output. Nanxian County alone grew 59,700 mu of jute and ambari hemp and produced 480,400 dan to place it in the first rank of production. Most of the province's jute and ambari hemp is grown in the lake region.

(IV) Sugarcane: The southern part of the province has grown sugarcane for a long time, and the "Dao County sugarland" is rather well known. However, much of what had been grown in the past was fruit cane, which develops slowly. Following liberation, superior species were gradually introduced and sugar refining techniques improved. In the 8 years prior to 1958, the average area sown to sugarcane annually was about 43,000 mu. In the 3-year period 1958-1960, the annual average was more than 140,000 mu as the growing of sugarcane spread from southern Hunan to western Hunan and on to the lake region of northern Hunan. Nevertheless, throughout the 1960's the area planted to sugarcane in the province annually averaged only 40,000-odd mu, but a gradual comeback has taken place since the 1970's. In 1979, the area sown to sugarcane in the province totaled 215,200 mu, or 397.78 percent of the 1965 amount, and output totaled 13,255,000 dan, which was 611.65 percent of the 1965 amount. Today sugarcane is centered in southern and northern production areas. The first area is the basins among the mountains of southern Hunan where heat and moisture conditions are fairly good, the growing season long, and people are in the habit of growing cane. In 1979, this region had 26.25 percent of the cane growing area and produced 21 percent of the cane, most of it in Jiangyong, Daoxian, Ningyuan, Lingling, Qiyang, Linwu, Chenxian, and Yizhang counties. The other growing area is the plain of Dongting Hu in northern Hunan where the soil is fertile and moist, and where most of the growing is done on state-owned farms. In 1979, 43.4 percent of the province's sugarcane growing area was located here, and the area produced 53.6 percent of all sugarcane grown in the province, most of it on Dayong Hu, Western Dongting, Qianniang Hu, Quyuan, Jinpen, Qianshanhong, Chapanzhou, and Beizhouzi farms. A substantial amount of total output also came from Hanshou and Liuyang counties, from Shaoyang Municipality, and from Shupu, and Huayuan counties.

(V) Tobacco (including flue-cured and sun-dried tobacco): The province has a long history in the growing of tobacco, but most past production was of sun-dried tobacco. It was not until after 1965 that output of flue-cured

tobacco vaulted into first place. In 1979, the area of the province planted to tobacco totaled 785,000 mu, and output totaled 1,220,900 dan. This was 363.43 and 583.60 percent respectively of the growing area and output for 1965. In terms of regional distribution, Linzhou and Lingling prefectures in southern Hunan together accounted for 47.83 percent of the total area sown to tobacco and for 53.34 percent of total output for the province, an overwhelming percentage being flue-cured tobacco. Most of the tobacco was grown in Guiyang, Laiyang, Yongxing, Chenxian, Xintian, Jianghua, Daoxian, and Dongan counties. Qianyang Prefecture and the Tujia and Miao Nationality Autonomous Zhou of western Hunan had 15.35 percent of the total area sown to tobacco in the province and produced 11.88 percent of output, which was equally divided between flue-cured and sun-dried tobacco. Major producing areas were Zhijiang, Xinhuang, Yuanling, Longshan, Yongshun, Sangzhi, and Fenghuang counties. Shaoyang Prefecture had 8.61 percent of the province's tobacco growing area and 10.14 percent of output, most of it in Xinshao, Longhui, Wugang, and Shaoyang counties. Other places such as Hengyang, Hengnan, Shimen, Linli, Ningxiang, Yuehang, and Liuyang counties also produced some.

III. Animal Husbandry

(I) Domesticated hogs. Hogs are an important barnyard animal raised in rural villages everywhere throughout the province, local breeds predominating. Central Hunan is the major area for production of three superior breed hogs, one of which is Great Enclosure hogs, so named because they are raised within great embankments along the shores of the Xiang Jiang (at Datuo Commune) in Changsha County. They mature early, fattening as they grow, tolerate coarse fodder, are very fecund, and produce both fat and lean meat. Ningxiang hogs originally came from the area along the Liusha He and Caochong in Ningxiang County, and are also known as Liusha He hogs. They mature early and fatten easily. They produce a lot of fat and their flesh is finely textured and tender. Shaziling hogs are grown around Shaziling in Changcheng in the suburbs of Xiangtan and at Hutan Commune. They mature early and fatten readily, produce a fairly large number of shoats, are fairly tolerant of coarse fodder, and have a delicious flesh. The aforementioned kinds of hogs (and particularly the last two) account for a substantial percentage of all hogs grown in the province and are fairly widespread. Most places in Shaoyang Prefecture are in the habit of raising Ningxiang hogs as well as Longtan hogs, Dongshan hogs, and Lijiaping hogs. Because of the many flood calamities that have occurred historically in the lake region of northern Hunan, sources of hog species are fairly complex. Local hog species such as Taoyuan black hogs (also known as Yanquan black hogs) are strongly tolerant of coarse fodder. They may be either fed fresh fodder or allowed to forage for themselves. They have a rather good body shape, are sturdily built, and are found in all nearby counties. In addition, the mottled hogs of Nan County in the lake region are a fairly good economic type hog. The very mottled hogs, the Zixing old market hogs, and the Shiqi Market hogs of Dongan in southern Hunan are superior provincial hog breeds. Most hogs in northwestern Hunan are black hogs, and black hogs from Luxipu market are famed. Mostly very mottled hogs and a small number of white hogs are grown in central and southern Hunan. Mottled hogs from Longtan in Shupu, mottled

hogs from Liangsan in Xinhuang and from Dongshan in Suining, and black hogs from Dafuping in Yuanling also have distinctive features. Simultaneous with the selective breeding of local superior hog varieties, all jurisdictions are also introducing superior breeds such as Yorkshires and Landraces for crossbreeding, and are actively engaging in the export of pork.

In 1979, a total of 37,459,600 head of hogs were raised throughout the province, 40.20 percent of them in central Hunan, 23.03 percent in western Hunan, 20.03 percent in northern Hunan, and 16.74 percent in southern Hunan. Of the total, 1.1 million head were raised in Ningxiang, 710,000 to 1 million head in Changsha, Lianyuan, Shaodong, Taoyuan, Wangcheng, Pingjiang, Xiangtan, Liuyang, and Lixian counties, 610,000 to 700,000 head in Changde, Xiangxiang, Hengyang, Xinhua, Hengnan, Longhui, Qidong, and Yiyang counties, 510,000 to 600,000 head in Shaoyang, Shuangfeng, Yueyang, Cili, Youxian, Qiyang, Liling, Xinshao, and Dongkou counties, 410,000 to 500,000 head in Anbei, Taojiang, Lingling, Shimen, Changning, Hanshou, Laiyang, Ningyuan, Yuanjiang, Xiangyin, Wugang, Miluo, and Huarong counties, and less than 400,000 head elsewhere. Hunan Province is a major base in China for production of marketable pork, and central Hunan is the major producing area in the province.

(II) Plow oxen. Plow oxen are mostly either oxen or water buffaloes, water buffalo providing most of the animal power in Hunan Province. During the early period following liberation, 39 percent of the province's more than 2.33 million head of plow oxen were water buffaloes. In 1979, 48.8 percent of the 3,271,600 plow oxen were water buffaloes. The province's water buffalo are fairly rugged, and Category I and II water buffaloes can do a lot of work, plowing 4 to 6 mu a day. Lakeshore water buffaloes are tall and able to do a lot of work. They are one of the province's superior breeds. Mountain and hill region water buffaloes are somewhat second rate, and those from southern Hunan are quite inferior. Oxen usually do not have large bodies and are suited to working in mountain areas. Western Hunan oxen are strong and sturdy, and are able to work for fairly long periods of time. In 1979, draft oxen able to work accounted for 70.71 percent of all plow oxen in the province, each head being responsible for an average of about 22 mu of cultivated land, or for 26 mu in northern Hunan, and around 14 mu in southern and western Hunan. Each ox in central Hunan was responsible for an amount of land between the northern and southern Hunan figure.

In addition to oxen, Hunan Province has an estimated 9,811 head of horses, donkeys, and mules, most of them in Changde Prefecture, which has 36 percent of the total number. The second largest numbers are in Yiyang, Yueyang, Shaoyang, and Qianyang prefectures, where they are used for hauling and as draft animals. As of the end of 1979, 876,600 head of sheep and goats were in inventory, 99.7 percent of them goats, which were located mostly in Changde, Lianyuan, Shaoyang, and Qianyang prefectures, and in the province's autonomous zhou.

IV. Forests, Tea, Fruit, and Mulberry

(I) Forests: Hunan has a temperate climate and copious rainfall; its soil is fertile, and it has many kinds of trees suiting it to the growth of

diverse kinds of forests. It is one of the main forest regions south of the Chang Jiang. Among the eight southern provinces in the "pine, fir, and miscellaneous other forest region," Hunan Province's forest resources are regarded as plentiful. Mostly its forests are timber forests of pine, fir, and nan bamboo, and special purpose economic forests of tea oil and tung trees.

The ranking of forest resources in each county in terms of four categories of timber, moso bamboo, tea oil, and tung tree reserves and area as of the end of 1976 is shown in Table 23.

Table 23. Ranking by County of Timber Reserves in the Whole Province

(a) 蓄积量(万立米)	>1000	800—1000	600—800	400—600	200—400	100—200	<100
(b) 县 数(个)	4	2	3	5	15	14	
(c) 县 名	(d)沅陵• (e)绥宁• (f)会同• (g)道县•	(h)靖县• (i)安化	(j)汝城 (k)资兴 (l)酃县	(m)城步• (n)江华 (o)双牌 (p)浏阳 (q)黔阳•	(r)怀化、永顺 (s)溆浦、芷江 (t)宜章、永兴 (u)平江、古丈 (v)辰溪、桑植 (w)醴陵、洞口 (x)蓝山、祁阳 (y)新晃	龙山、茶陵 (z) 石门、慈利 (aa) 麻阳、道县 (ab) 桂东、大庸 (ac) 宁远、新宁 (ad) 桃源、新化 (ae) 保靖、邵阳 (af)	其余各县 (ag)

Key:

a. Amount of reserves (10,000 cubic meters)
b. Number of counties (individual counties)
c. Name of county
d. Yuanling*
e. Suining*
f. Huitong*
g. Daoxian*
h. Jingxian*
i. Anhua
j. Rucheng
k. Zixing
l. Lingxian
m. Chengbu*
n. Jianghua
o. Shuangpai
p. Liuyang
q. Qianyang*
r. Huaihua, Yongshun
s. Shupu, Zhijiang
t. Yizhang, Yongxing
u. Pingjiang, Guzhang
v. Chenxi, Sangzhi
w. Liling, Dongkou
x. Lanshan, Qiyang
y. Xinhuang
z. Longshan, Chaling
aa. Shimen, Cili
ab. Mayang, Daoxian
ac. Guidong, Dayong
ad. Ningyuan, Xinning
ae. Taoyuan, Xinhua
af. Baojing, Shaoyang
ag. Other counties

The foregoing table shows a total of 187 million cubic meters of living timber reserves in the province, most of it in mountain regions of western and southern Hunan. Reserves in the seven counties (denoted by *) in the middle and upper reaches of the Yuan Shui account for 15 percent (15 million mu) of the province's total forest area, and for 30 percent of the province's

total forest reserves (63.7 million cubic meters). The 17 counties in the middle and upper reaches of four tributaries to the Xiang Jiang, the Xiao, Chun, Lai, and Mi rivers together account for 24 percent of the province's total forestland area (23,018,000 mu), and for 25 percent of total reserves (47,177,000 cubic meters).

Table 24. Ranking by County of the Province's Moso Bamboo Reserves

Reserves (10,000 stalks)	>3,000	2,000-3,000	1,000-2,000	<1,000
Number of counties	6	11	15	
Names of counties	Taojiang Liuyang Suining Xinhua Anhua Shuangpai	Taoyuan, Dongkou Xinyi, Longhui Hengyang, Chengbu Youxian, Xinshao Lingxian, Huitong Hengshan	Laiyang, Andong Rucheng, Qianyang Chaling, Zixing Chenzhou, Lingling Yiyang, Changning Pingjiang, Lanshan Lianyuan, Shuangfeng Linxiang	Other counties

The foregoing table (24) shows the province's principal moso bamboo growing area to be a basically pearl-shaped mountain and hill region around central Hunan that frequently occurs in conjunction with mountainlands in which a weathered stratum of granite, sandy shale, and slate is fairly well developed and where there is much rainfall. The province's moso bamboo area ranks fifth in the entire country, and gross output ranks third.

Table 25. Ranking by County of the Province's Tea Oil Growing Area

Area (10,000 mu)	>100	80-100	50-80	30-50	<30
Number of counties	2	2	9	21	
Name of counties	Laiyang Liuyang	Taoyuan Pingjiang	Liling, Yongxing Changning, Huaihua Shupu, Lingling Yongshun, Daoxian Hengdong	Qiyang, Changde Zhuzhou, Qianyang Chenzhou, Chenxi Zixing, Hengyang Ningyuan, Yuanling Huitong, Chaling Lanshan, Guiyang Longshan, Linxian Dongan, Hanshou Youxian, Mayang Shaoyang	Other coun-ties

Forty-three counties in the province have a tea oil area of more than 150,000 mu (as shown in Table 25), most of them in the Xiang Jiang basin and in the red soil hill region of the Yuan Shui basin. These counties stand first in the country both in terms of area and output.

Table 26. Ranking by County of the Province's Tung Tree Area

Area (10,000 mu)	20-40	5-15	1-5	<1
Number of counties	6	5	12	
Name of county	Longshan, Yongshun Baojing, Shimen Dayong, Cili	Luqi, Guzhang Yuanling, Huitong Sangzhi	Mayang, Fenghuang Qianyang, Shupu Jishou, Xinhuang Lixian, Xinning Zhijiang, Chenxi Taoyuan, Shaoyang	Other counties

The foregoing table (Table 26) shows most of the province's tung trees to be in western Hunan, and particularly in northwestern Hunan, where they have developed widely in the yellow soil made of limestone and sandy shale mother material, which generally ranges from neutral to slightly alkaline. This soil condition, plus the more than 200 millimeters of precipitation during July and August, the period when tung trees are vigorously growing fruit and increasing the amount of oil they produce, assures high and consistent tung oil yields. The 10 counties between Longshan and Cili counties contain more than 80 percent of the province's total tung oil area. During the 1950's the province produced about 400,000 dan of tun oil annually, making it second only to Sichuan and number two in the whole country. In recent years, annual tung oil output has been only around 200,000 dan, and the province has dropped to fifth place in the country.

(II) Tea: Hunan is in the western part of the country's "tea region south of the Chang Jiang." Climate in this region is temperate, and much red and yellow soil is found in its low mountains and hills and on gentle slopes at an elevation above sea level of less than 1,000 meters. Such places are suited to the growth of tea bushes, which are perennial, have deep root systems, and love mildly alkaline soil. The growing of tea in Hunan Province began during the Han Dynasty and developed during the Tang and the Song reaching its peak during the 1930's. Tea varieties are also numerous and varied. Black tea produced in Anhua, Xinhua, Shimen, Pingjiang, and Dongkou counties has been renowned in international markets. Black tea from Anhua, Hanshou, and Ningxiang counties, and aged green tea from Linxiang have enjoyed a special market in border regions. Green tea produced in Xiangyin and Yueyang counties as well as in Guzhang County is flavorful and mellow; it sells well in China. The province mostly produces black tea today, plus a certain amount of green tea. Famous teas from various places such as "Junshan Yinzhen," "Beigang Maojian," "Gaoqiao Yinfeng," "Xiang Boyuan," "Shaofeng" and "Anhua Songzhen" from Shaoshan, plus "Guzhang Maojian," "Jianghua Baimaojian," and "Weishan Maojian" maintain and develop their traditional features.

Most of the province's tea plants are bushy with tight branches, and the province has plentiful specie resources. A survey done in 25 counties including Anhua and Xinhua showed 98 communities or types. Representative

local varieties include Yuntaizhong from Anhua (a substantial number of large leafed plants, becoming medium sized leaf communities when introduced to other hill regions), bitter tea from Jianghua (small shrubs with large leaves), and early tea from Guzhang. Recent years have also witnessed the discovery of precious resources such as Chengbudong tea, Lanshan green leaf bitter tea, and Rucheng Baimao tea. Research on and use of bitter tea from Jianghua has brought the quality of the province's broken black tea up to new levels set by the second set of national standards. Newly bred Xiangbo green, Gaoqiao early, Zhuye uniform, and Changbo green have their own individual characteristics. In addition 10 additional tea plant varieties have been introduced including Dabai from Fujian, Shuixian from Guangdong, and Dayezhong from Yunnan, and the area planted to superior varieties is increasing.

Following liberation, tea production in the province experienced a renaissance with the planting of tea over different size areas in all the counties of the province. In 1979, the province had 2,511,000 mu of new and old tea plantations and produced 1,146,700 dan of tea. This was a 2.84-fold increase in area and a 2.01-fold increase in output over 1965. Thirty-three counties produced more than 5,000 dan of tea annually, and 24 of them were principal producing areas (with an area of more than 20,000 mu and an output of more than 10,000 dan of tea). Tea plantations in these counties covered a 1,642,600 mu area and produced 931,000 dan of tea. This was 65.42 percent of the area planted to tea in the province and 81.19 percent of output. Ranking of these counties in order of their tea output was as follows: Linxiang, Anhua, Taojiang, Yiyang, Lianyuan, Ningxiang, Hanshou, Shuangfeng, Pingjiang, Dongkou, Liuyang, Xinhua, Xiangyin, Shaodong, Miluo, Changsha, Xiangxiang, Yueyang, Taoyuan, Linli, Wugang, Longhui, Changde, and Liling. Secondary producing areas were Youxian, Shupu, Shimen, Yuanling, Yuanjiang, Xiangtan, Zhuzhou, Chaling, Laiyang, Qiyang, and Lanshan counties. counties produced odd lots of tea.

Hunan's main and secondary tea producing areas are concentrated in the central and northern parts of the province, with principal producing areas located to the east of the Xuefeng Shan and the Wuling Shan and to the north of a line running through Shaoyang, Hengshan, and Youxian. This is partly the result of natural conditions such as Anhua County's location in the mist-shrouded mountains and hills along the gorges of the lower reaches of the Zi Shui. Anhua, together with neighboring counties around it are in the center of the area of heavy rainfall in the province. Pingjiang and Liuyang are also located in a heavy rainfall area. Linxian gets relatively less rainfall, but most of that area has a deep layer of soil developed out of weathered shale, which favors growth of tea bushes. Of more importance is that tea is a cash plant that is highly marketable. As the people's standards of living have risen, their need for tea has increased. In addition, there is no shortage of workforces in tea producing areas; needs for grain have been substantially met; there is a tea growing tradition; and availability of water and land transportation permits collection and distribution of tea. As a result, in recent years tea production has developed very rapidly in the hill regions of central and northern Hunan.

(III) Fruit trees: Hunan Province has abundant fruit tree resources. The major citrus producing areas are in the basins and valleys on both sides of the Xuefeng Shan, with some production in central, southern, and northern Hunan. Bayberries are found throughout southern Hunan, and Jingxian County bayberries are a superior variety. Loquats are found throughout northwestern Hunan. Yuanjiang loquats are an early ripening specie. Chinese chestnuts are found mostly in northwestern Hunan. The mountain walnuts of southwestern Hunan are famous. In addition, the province also produces persimmons, pears, peaches, sweet and sour plums, and dates.

The province is located in the central part of the sub-tropical citrus growing belt where the area suited to the growing of citrus is widespread and varieties numerous. Superior varieties of oranges that have been examined and approved for development include: Bingtang oranges, Pushi sweet oranges, Shupu sweet oranges, Dahong sweet oranges, Jingxian blood oranges, and Shaoyang navel oranges. Delicious superior Wenzhou Mandarin orange varieties include Zaoshu No 1 from Longhui and Changsha, and Zhongshu No 1 from Shaoyang and Hengyang. Other local varieties include southern tangerines with few seeds from Yuanjiang, Yongshun sweet tangerines, Changsha and Hengnan honey oranges, kumquats from Lanshan and Liuyang, Anjiang pomelos, chrysanthemum shaped heart pomelos from Dayong, and sweet pomelos from Cili, all of which are fairly well known.

Fruit production in the province emphasizes citrus, and a large area is planted to citrus fruit. In 1979 citrus orchards covered 848,400 mu or 74.5 percent of the total orchard area, up 8.27-fold from 1965. In 1979, output was 1,229,100 dan, or about 52.2 percent of total fruit output and 440,000 dan more than in 1975. Currently 97 percent of all counties (or municipalities) are developing citrus production to varying degrees. In 1979, 51 counties (and municipalities) had a citrus output of more than 3,000 dan. Those with an output of from 10,000 to 100,000 dan included Liyang, Wugang, Xinning, Xinhua, Xinshao, Shaodong, Daoxian, Qianyang, Chenxi, Lianyuan, Shaoyang, Hengshan, Hengdong, Hengnan, Zhuzhou, Shimen, Longhui, Suining, Lingling, Dongan, Jiangyong, Qiyang, and Shupu counties, plus Xiantan, Changsha, and Zhuzhou cities. Those with an output of more than 100,000 dan were concentrated mostly in the Yuanjiang, Dongkou, and Shaoyang City area, and accounted for one-third of the province's total output. This demonstrates a basic wide area distribution with concentration in a small area. New areas are expanding, and old areas are steadily developing.

(IV) Silkworm mulberry: Formerly a considerable amount of silkworm mulberry was grown on lake plains, but expansion to Xiangtan Prefecture and to other counties occurred subsequently. The growing of silkworm mulberry is not generally concentrated in particular areas, but rather rises and falls as the growing of farm crops expands. After 1962 mulberry groves stabilized at 45,000 mu each year and output of silkworm cocoons was around 7,800 dan. Since 1972, output has averaged 9,000 dan annually. In 1979, the mulberry growing area of the province totaled 127,400 mu and cocoon output was 32,300 dan. This was a 7.24-fold increase in the mulberry growing area, and a 5.43-fold increase in cocoon output that surpassed the

all-time record since liberation. In the same year, 14 lake counties accounted for 30 percent of the mulberry grove area and for 42 percent of cocoon output. Eight counties produced more than 1,000 dan of cocoons. They were Yueyang, Huarong, Changde, Lixian, Xiantan, Xiangxiang, Liuyang, and Chaling. Huarong's output was more than 5,000 dan. Seven counties in Xiangtan Prefecture accounted for 36.2 percent of the province's mulberry grove area and for 34.4 percent of its cocoon output. Xiangtan, Xiangxiang, Liuyang, and Chaling counties each produced more than 1,000 dan of cocoons, with Liuyang County producing more than 4,000 dan.

V. Aquatic Products

Hunan Province has fairly plentiful aquatic products. Surveys show a total of more than 165 species of fish in Dongting Hu and parts of the Xiang, Zi, Yuan, and Li rivers. There are more than 20 types of principal economic fish species including black carp [Mylopharyngodon piceus], grass carp [Ctenopharyngodon idellus], silver carp, variegated carp, common carp [Cyprinus carpio], crucian carp, bream, Chinese whitefish, Xenocypris argentea, minnow fish [Elopichthys bambusa], catfish, long-tailed anchovies, and whitebait. In addition, the province produces rare fish such as Chinese paddlefish, A. sinensis, hilsa herring, and Mandarin fish, and valuable aquatic animals such as black finless porpoise, giant salamander, and Lipotis vexillifer.

The Dongting Hu system is well developed with numerous river mouths. It is crisscrossed by streams, and grass covered sandbar islets abound. Each spring and summer the lake's waters rise and large numbers of parent fish from rivers and lakes congregate around the grassy islets and at the mouths of rivers for breeding, making this the largest fish breeding ground in the province. The time for catching fish each year (March-May) is called the "spring flood," and it has been during this period in recent years that a large percentage of total catches for the year have been taken, as for example 13 percent for Yueyang County, 30 percent for Yuanjiang County, and 30 percent for Hanshou County. Since the soil on the lake islets is fertile, reeds and aquatic grasses proliferate, and food organisms are abundant. Once the waters rise during spring and summer, the lake islets are drowned. Not only do young fish bred in the lake congregate to feed here, but also a considerable number of young fish that reproduce in the Chang Jiang and the four rivers also migrate into the lake to feed and fatten. Consequently Dongting Hu is one of the main feeding lakes for young economic fish in the Chang Jiang Basin. This period for catching fish each year (June-August) is termed the "high water." Volume of catches taken during this period in recent years as a percentage of catches for the total year amounted to 53.4 percent for Yueyang County, 20 percent for Yuanjiang County, and 15 percent for Hanshou County. Once autumn arrives (September-November), the lake waters gradually recede and the weather gradually turns cold. Migratory river and lake fish leave the lake to return to rivers as the waters recede. The permanent fish inhabitants of the lake gradually go into deep parts of the lake or into deep parts of rivers to overwinter. This period for catching fish each year (September-November) is termed "falling firewood." Catches during this period as a percentage of the annual total have been

25.4 percent for Yueyang County, 25 percent for Yuanjiang County, and 20 percent for Hanshou County. The catching of fish during the period when they have submerged to overwinter is termed "winter catch" (December till February of the following year). Catches taken during this period in recent years as a percentage of the annual total have been 25.4 percent for Yueyang County, 25 percent for Yuanjiang County, and 20 percent for Hanshou County. Formerly the basins of the four rivers also produced many kinds of fish, as for example the Xiang Jiang's prolific production over the years of silver carp, variegated carp, grass carp, black carp, bream, common carp, Xenocypris argentea, and minnow fish. These rivers also provide fine environmental conditions in river beds for spawning and reproduction. For various reasons, very great changes have taken place in the province's resources. A look at volume of catches, volume of fry caught, and kinds of fish caught shows a trend toward decline in a curve. In recent years, all jurisdictions have used inland lakes, reservoirs, and ponds for the breeding of domesticated fish, with development being fairly rapid in the lake region and along the banks of the Xiang Jiang.

Table 27. Table Showing Growth of Fish Rearing by Years

(a) 年份	(b) 放养水面 (万亩)	(c) 鱼产量 (万担)		
		(d)合计	(e)其中：养殖	(f)占鱼产(%)
1949		86.8	15.84	18.2
1957	225.20	238.70	163.70	68.2
1965	364.17	163.11	108.71	66.6
1971	385.47	181.32	138.74	76.5
1975	403.04	208.16	176.46	84.6
1979	397.29	260.61	227.77	87.4

Key:

a. Year
b. Water surface breeding area (10,000 mu)
c. Fish output (10,000 dan)
d. Total
e. Including: breeding
f. Percentage of fish output

Total fish output shown in the foregoing table (27) includes both catches and breeding for the purposes of comparison. Over the years Hengyang Prefecture has held first place in volume of breeding, followed by counties around the lake region. In 1979, output from fish breeding was 2,277,700 dan, and the ranking of prefectures was as follows: Hengyang 20.2 percent, Changde 13 percent, Yueyang 12 percent, Xiangtan 9.36 percent, Yiyang 8.96 percent, and Shaoyang 4.37 percent. All other places produced relatively little.

Aquatic plants and animals other than fish are also very plentiful. Shellfish number more than 40 species including triangular fan clams [0005 6037 1581 5738], wrinkled guan clams [4126 4773 0385 5738], and liuli clams

[4058 7787 5738], most of which are found in the lake region. Snail varieties are numerous and are found over a very wide area. Common shrimp varieties include marsh shrimp [3113 5802] and long arm shrimp [7022 5242 5802], most of them being produced in the Dongting Hu region. Also produced are some valuable aquatic animals such as western Hunan salamanders, Dongting Hu white finless porpoises, black finless porpoises, tortoises, and soft shelled turtles. Aquatic plants of appreciable economic value include lotus, water chestnuts, Gorgon fruit, arrowhead, mat grass, cattails, and rushes. Rushes are found all over the Dongting Hu region, and rushes grow particularly thickly at Piaowei, Beizhou, and Jianxin on eastern Dongting Hu and outside Chunshan farm, as well as at Dawan and Laogang.

3. Striking Lack of Diversification in Structure of Agricultural Economy

All sectors of the province's agriculture as well as an overwhelming majority of its elements have developed to different degrees. Proportional output value of all agricultural sectors during the past 10 years has been as follows: relative stability in the farming industry, increases in animal husbandry, lessening in forestry and sideline occupations, and fluctuation in the fishing industry. Farming has held prime position with forestry bringing up the rear, a gap existing between the two. (Table 28)

Table 28. Structure of Output Value of All Agricultural Sectors in the Province

(a) 类别	1949年		1965年		1971年		1973年		1975年		1979年	
	(h) 产值 (亿元)	(i) 比重 (%)	(h) 产值 (亿元)	(i) 比重 (%)	(h) 产值 (亿元)	(i) 比重 (%)	(h) 产值 (亿元)	(i) 比重 (%)	(h) 产值 (亿元)	(i) 比重 (%)	(h) 产值 (亿元)	(i) 比重 (%)
(b) 农业总产值	15.84	100	32.51	100	63.77	100	74.07	100	80.16	100	94.16	100
(c) 农业	12.05	76.07	21.07	64.81	43.42	68.09	50.48	68.15	54.41	67.88	65.47	69.53
(d) 林业	0.24	1.52	1.31	4.03	2.72	4.26	2.77	3.74	2.86	3.57	3.13	3.33
(e) 牧业	1.42	8.96	4.42	13.60	9.18	14.40	10.93	14.86	11.64	14.52	14.26	15.15
(f) 副业	2.10	13.26	5.31	16.33	7.92	12.42	9.32	12.58	10.61	13.23	10.52	11.17
(g) 渔业	0.03	0.19	0.40	1.23	0.53	0.83	0.57	0.77	0.64	0.80	0.77	0.82

Key:
- a. Category
- b. Gross output value of agriculture
- c. Farming
- d. Forestry
- e. Animal husbandry
- f. Sideline occupations
- g. Fishing industry
- h. Output value (100 million yuan)
- i. Percentage

I. Output Value of Farming in Which Grain Production Predominates

The province's farming industry includes the growing of grain crops, soybeans, cash crops, vegetables and melons, and green manure, plus production

of other farm crops, which take up all cultivated land and more than 95 percent of the province's workforces. Farming accounts for more than 65 percent of the total output value of agriculture.

The dominance of paddy rice in the farming industry, with dryland grain production being ancillary, has existed for a long time everywhere in the province. Thus, not only is paddy rice production the mainstay in the output value of the farming industry, it also holds a crucial position in the gross output value of agriculture as a whole. Since liberation, the ratio of grain crops to gross output value of agriculture has been as follows: During the 1950's (1950-1959), an average 48.8 percent; during the 1960's (1960-1969), 45.74 percent; and since the 1970's (1970-1975), 49.5 percent. Paddy rice has been prominent in the output value of grain crops. For example, in 1974 and in 1979 grain crops accounted respectively for 51.41 percent and 53.78 percent of gross output value of agriculture, with paddy rice accounting for 39.65 and 48.48 percent respectively.

Output value of crops other than grain has also increased and changed in varying degrees. Cash crops as a percentage of the farming industry and of the gross output value of agriculture averaged 3.17 percent during the 1950's, 4.17 percent during the 1960's, and an average 4.57 percent since the 1970's, and during the 2 years 1974 and 1975 they averaged 5.16 percent of the gross output value of agriculture. This included 3.02 percent for cotton, with the percentage for other similar crops being substantially close during the past 2 years. Average value as a percentage of the gross output value of agriculture was 0.44 percent for soybeans, 5.78 percent for vegetables and melons, 3.7 percent for green manure, 1.18 percent for tea, mulberry, and fruit combined, and 0.04 percent for other crops.

In 1979 the farming industry accounted for 69.53 percent of the gross output value of agriculture. This included 53.16 percent for grain crops and 16.37 percent for other crops, demonstrating the commanding position of grain production in agriculture and the lack of diversification of the economic structure.

II. Output Value of Animal Husbandry Dominated by Hog Production

Up until 1964, the province's animal husbandry industry accounted annually for about 11 percent of the gross output value of agriculture. Thereafter, it was around 13 percent, holding third place. After 1972, it rose to second place. In 1979, the animal husbandry industry accounted for 14.26 percent of gross output value, with livestock accounting for 12.57 percent and poultry for 0.91 percent. Output value of live poultry and livestock was 1.52 percent, and raising of other animals accounted for 0.15 percent.

Livestock raising has formed the bulk of the animal husbandry industry over the years, the raising of oxen and other large draft animals predominating, and the numbers of sheep and goats not amounting to much. However, hog production has been appreciable, has developed rapidly, and marketable amounts have been substantial. Up until 1968, the province produced fewer than 20 million hogs a year, but after 1968 the number rose to between 20 and 30

million, and the number of fattened hogs removed from inventory rose year by year as well. During the 5-year period 1966-1970, an average 8.66 million head were removed from inventory annually, the state annually purchasing more than 4.9 million head or 56.58 percent of the total. Between 1971 and 1979, the state annually purchased an average 8.59 million head, which was 64.6 percent of the average 13.3 million head removed from inventory during the same period. This provides a general idea of the importance of hog production in the gross output value of animal husbandry, and is also closely related to the province's advances in grain production.

III. Output Value of Sideline Occupations, Principally Brigade Operated Enterprises

Rural sideline occupations are of numerous kinds in Hunan Province and include mostly gathering, hunting and fishing, plaiting, processing of agricultural sideline products, excavating, operation of kilns, construction, and hauling. Output value from these occupations has been equal to or slightly ahead of that of the animal husbandry industry in the gross output value of agriculture over the years, taking third place in the province since 1973.

In 1979, sideline occupations accounted for 11.17 percent of the gross output value of agriculture. This included 3.05 percent from gathering, 0.01 percent from the hunting and catching of wild animals and wild birds, and 8.12 percent from production brigade and production team sideline occupations, demonstrating that commune and brigade enterprises are rising and developing.

IV. Output Value of Forestry Consisting Primarily of Timber and Bamboo Production

Following liberation, during the period 1950 to 1979 the province's output of timber products amounted to a cumulative 64.59 million cubic meters. Output of marketable moso bamboo was 36.38 million stalks, of rosin 414,200 tons, of tea oil 22,645,000 dan, and of tung oil 8,513,200 dan. The province ranked first and third respectively in the country in output of tea oil and moso bamboo. During the 30 years between 1950 and 1979, the province provided the country with more than 62 million cubic meters of timber, more than 3 billion stalks of nan bamboo, more than 22 million dan of tea oil, and 8.1 million dan of tung oil, and supplied other forest sideline products as well.

Despite a general inventorying of the province's forest resources following liberation, failure to set up resource management files and lack of periodic re-surveys meant that after a certain period of time, figures for growth and decline of resources and for the barren mountain area became no longer certain. Coniferous forests account for 87 percent of the province's existing forest resources, with masson pine area and reserves accounting for half of all timber forests. Furthermore, there are numerous forests of single kinds of trees, but few mixed forests, and damage from diseases and insect pests is serious. In a considerable number of places, once forests

have been felled there has been no prompt replacement of them, and a considerable area of economic forests such as tea oil and tung tree forests should be restored in a rational way. In addition, the timber utilization rate is fairly low and waste serious. Despite a rise in output of timber, with steady development of the national economy, the conflict between supply and demand has become increasingly prominent. Overall, forestry is a weak link. Output value of forestry as a percentage of gross output value of agriculture over the years was less than 2 percent each year up until 1970. Since the 1970's, it has been a general 2 to 3 percent. In 1979, it was 3.33 percent for the country as a whole. Output value of forestry as a percentage of the gross output value of agriculture in various prefectures was as follows: 7.66 percent for Qianyang, 6.74 percent for the western Hunan autonomous zhou, 6.26 percent for Chenzhou, and 5.7 percent for Lingling. For all prefectures and cities in northern and central Hunan, it was less than the average output value for the province as a whole.

V. Output Value of the Fishing Industry in Which Breeding Is Dominant

Under guidance of a program of "taking breeding as the key link with simultaneous emphasis on breeding and catching," the province's aquatic products production has expanded rapidly since liberation. This has been reflected in a year by year rise in outputs from breeding, and a trend toward decline in the curve showing output from catches. During the 1950's (1950-1959), aquatic products output averaged 1,553,800 dan annually, 56.4 percent of which was from breeding and 43.6 percent of which was catches. During the 1960's (1960-1969), annual output averaged 1,552,000 dan, 59.4 percent from breeding, and 40.6 percent from catches. During the 1970's (1970-1979), annual output averaged 2,079,800 dan, 80.3 percent from breeding and 19.7 percent from catches. Comparison of the 1970's with the 1960's and 1950's shows incremental increases in output from breeding to have been 81.2 and 90.6 percent respectively, and decreases in output from catches to have been 35.1 and 39.6 percent respectively. Thus, despite year by year increases in output from breeding, as a result of substantial decline in output from catches, the province's gross fish output was not very consistent and rose only slowly. Average annual output for the 1970's was 33.8 percent greater than in the 1950's and 34 percent greater than in the 1960's.

The province's freshwater area amounts to only 6.44 percent of total land area, and natural lakes are rapidly becoming silted and smaller. In addition, water project construction on waterways entering lakes has caused the flow of water to be interrupted or polluted, with the result that very great changes have taken place in fish resources. Output from catches shows a trend toward decline. At the present time, the utilization rate for water surfaces that could be stocked with fish is fairly low, and a complete scientific management system is lacking. Output from breeding has yet to reach the levels it should, with the result that the fishing industry has accounted for the smallest percentage of the gross output value of agriculture, and there have been fairly great fluctuations. Except for 1959, when fishing industry output value reached a 2.07 percent high, in every other year since liberation, the average percentage has been lower than this.

During the 9-year period between 1949 and 1957, it did not reach 1.0 percent and averaged 0.36 percent. Production of fresh fish during the 11 years between 1958 and 1968 totaled 12,406,800 dan. In addition to quantities otherwise disposed of, the state purchased 3,959,900 dan during the same period for a marketable rate of about 32.0 percent, and the fishing industry provided 1.41 percent of the gross output value of agriculture. In the 6 years from 1969-1974, a total of 7,888,600 dan of fresh fish were produced, of which the state purchased 2.1 million dan for a marketable rate of 26.62 percent and the fishing industry provided an average 0.8 percent to the gross output value of agriculture. In 1975 the percent contribution to gross output value of agriculture by the fishing industry in individual prefectures was as follows: Yueyang, 1.8 percent; Hengyang, 1.44 percent; Yiyang, 1.02 percent; Changsha City, 0.98 percent; and all other prefectures and cities in the province less than the average for the province. In 1979, the province's fishing industry amounted to only 0.82 percent of the gross output value of agriculture.

4. Expansion of Production Produces Curve Rise

Since the founding of the nation, the province's agricultural production has steadily moved forward with a 494 percent rise in the province's gross output value of agriculture for 1979 versus 1949, or an average annual 6.1 percent increase. Gross output value of agriculture for 1979 versus 1965 was 189.63 percent, an average annual increase of 3.6 percent. (Table 29)

Table 29. Speed of Development of Individual Agricultural Sectors for the Whole Province

	1949年—1979年		1965年—1979年	
	(a)为 49 年 %	(b)年递增率(%)	(c)为 65 年 %	(b)年递增率(%)
(d) 农业总产值	594.44	6.1	289.63	7.9
(e) 其中：农业	543.32	5.8	310.73	8.4
(f) 林业	1304.17	8.9	238.93	6.4
(g) 牧业	1004.23	8.0	322.62	8.7
(h) 副业	500.95	5.5	198.12	5.0
(i) 渔业	2566.67	11.8	192.50	4.8

Key:
- a. Percent of 1949
- b. Annual rate of increase (%)
- c. Percent of 1965
- d. Gross output value of agriculture
- e. Including: Farming
- f. Forestry
- g. Animal husbandry
- h. Sideline occupations
- i. Fishing industry

Speed of development of four major representative items in the farming industry and the livestock raising industry, namely grain, edible oil, cotton, and hogs, as well as development of commune and brigade enterprises is summarized below as follows:

Grain production. During the 20 years between 1950 and 1970, grain output averaged more than 21 billion jin per year including 1960 and 1961 when it declined for 2 years as a result of temporary difficulties. In 1971, it suddenly began to break the 30 billion jin mark. In 1979, it reached 44.363 billion jin, which was a 348 percent increase over 1949 for an average annual 4.2 percent rate of increase. Grain yields per unit of area were 1,011 jin in 1979, which was 2.6 times greater than in 1949, and more than the proportional growth in gross output of grain. The situation in grain output per capita was as follows: 849 jin in 1979, versus 427 jin in 1949 for a 98.8 percent increase, or an average 422 jin per capita. Since the 1970's, commune and brigade reserves for the province as a whole have increased to more than 3 billion jin from the somewhat more than 1 billion jin at the outset. Contributions to the state amount to more than 5.75 billion jin annually. In 1979, the province provided 8.225 billion jin, or 18.5 percent of total output. Between 1970 and 1979, the province's grain output increased 5.5 percent annually making Hunan one of seven provinces with a fairly rapid speed of development. During the 2 years 1978 and 1979, gross output climbed to 41.7 billion jin and 44.3 billion jin respectively. This was a yield of more than 1,000 jin per mu of cultivated land.

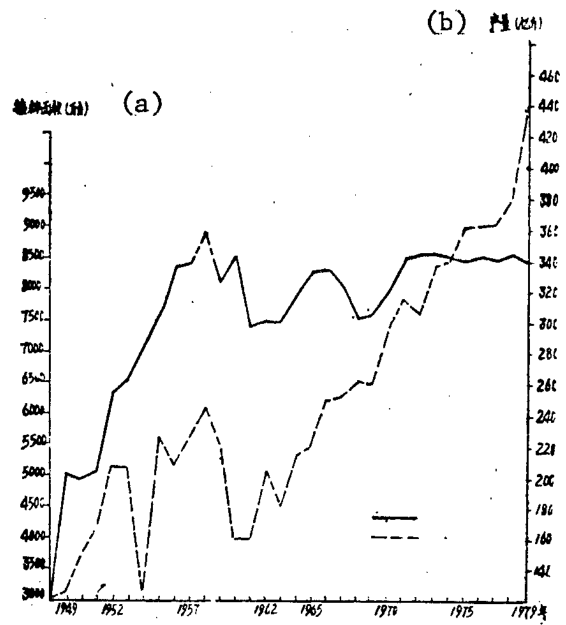


Figure 13. Curve Graph Showing Area Planted and Gross Output of Grain in the Province Over the Years

Key:
a. Area sown (10,000 mu)
b. Output (100 million jin)

Because of the large amount of rain that falls during the sowing and sprouting seasons, plus the lack of flat land in the province, Hunan Province's cotton production cannot compare with that of cotton growing areas north of

the Chang Jiang. However, comparison of the period before and after liberation shows two great changes as having taken place as follows: One was a rapid speed of development, and the other was relative concentration. The lower reaches of the four rivers and the lake plain in northern Hunan developed into fairly large area commodity cotton growing regions in the province. Many counties in central Hunan's hill and basin lands increased their cotton growing areas while many counties in southern and western Hunan curtailed their cotton output. In order to assure a certain cotton growing area and total output for the province, as well as in order to foster local production for self-sufficiency, when faced to a certain extent with the necessity to plant in scattered places everywhere, the tendency was to gradually concentrate production from around the edges of the province to the central and northern parts of it, and particularly to concentrate it gradually in each of the counties around the lakes.

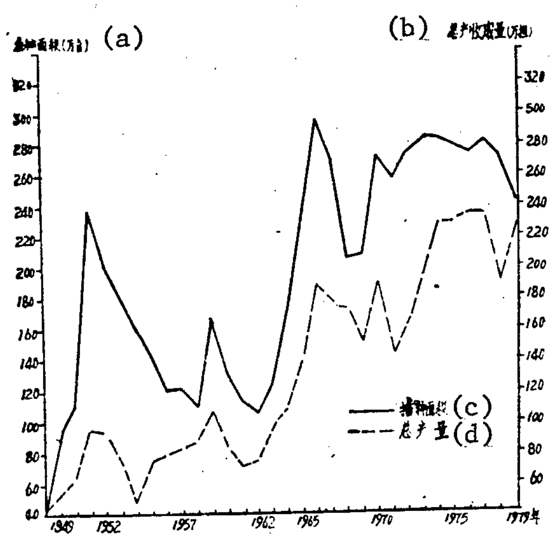


Figure 14. Curve Graph Showing Area Sown, Output and Amount of State Procurement of Cotton Over the Years in the Province

Key:

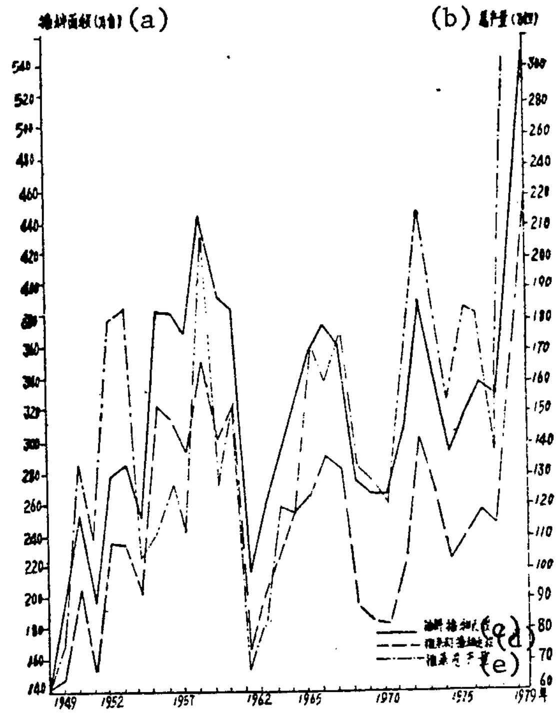
a. Area sown (10,000 mu)
b. Gross output and amount of state procurement (10,000 dan)
c. Area sown
d. Gross output

In the process of expanding cotton production, wavelike ups and downs occurred. In 1951, 2.39 million mu were sown to cotton, and output totaled 586,000 dan to beat the all-time high pre-liberation record year of 1941. From this time forward up until the early 1960's, only an average 1.3 million mu was planted each year, for an output of about 400,000 dan. Later on remarkable growth took place, and during the last several years, in particular, output has increased fairly rapidly. Despite a reduction in the area planted in 1975, output remained about the same as in 1974 totaling 1.9 million dan, which was double the 1965 output for an annual 6.6 percent increase. That year yields of ginned cotton averaged 68 jin per mu for the

province as a whole, and in 128 communes in 9 counties (or towns), yields were greater than 100 jin per mu providing the country with 1,676,300 dan, or 88.2 percent of gross output. In 1979, a 2,412,300 mu area of the province was planted to cotton, 360,000 mu less than in 1975, yet gross output reached 1,874,400 dan. Acting on the basis of the principle of "suiting general methods to local situations for appropriate concentration," during the spring of 1980 both the province and prefectures readjusted some of their cottonfield patterns. The cotton growing area of Changde and Yueyang prefectures increased by 340,000 mu, and 315,000 mu of scattered, low yield cotton growing areas were no longer used for cotton. For some time to come, the province's cottonfield area will remain stable at 2.5 million mu, output being increased mostly by increasing yields per unit of area.

The area sown to oil-bearing crops was increased to 4,201,800 mu in 1958. Prior to and subsequent to this time, the area was less than this figure and fluctuated around it. Maximum output of various kinds of oil-bearing crops was as follows: an increase in output of rapeseed from 1.36 million dan in 1977 to 4,574,000 dan in 1979. Peanut output was 1,235,500 dan in 1969 and sesame output was 219,800 dan in 1979. The years of maximum output for these two crops occurred after the close of the 1960's. Rapeseed accounted for the greatest percentage of the three oil-bearing crops in both area planted and gross output (Figure 15). Between 1966 and 1970, for example, rapeseed accounted for more than 75 percent of the total area sown to oil-bearing crops, and reached 83 percent in 1979, when output was 80 percent of gross output of oil-bearing crops. Furthermore, peanuts and sesame seeds were used mostly as nonstaple foods while rapeseed accounted for about 22 percent of the edible vegetable oil used in the province. Since the 1970's, attention has been devoted to expanding the rapeseed growing area and raising output. In 1979, gross output of rapeseed totaled 4,574,000 dan, the all-time high and a 168.9 percent increase over 1965. The overall situation in development of edible vegetable oil (including tea oil, rapeseed oil, peanut oil, sesame oil, and cotton seed oil) was a gross output of 2,793,100 dan in 1975, which was 234 percent more than in 1949, or an average 3.3 percent annual increase. In 1975, 479,500 dan of edible oil was contributed to the state, more than half the gross output of 1949.

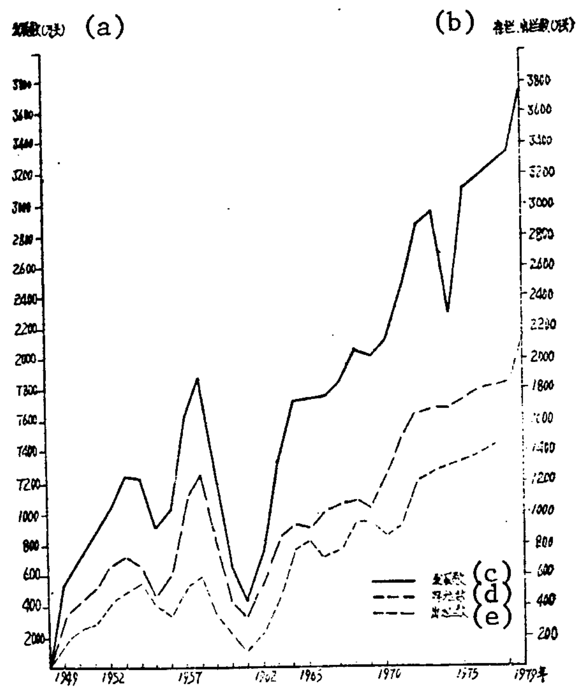
Hog production has developed fairly rapidly. During the 3 years prior to 1966, hog raising averaged less than 16 million head per year. Thereafter, the yearly average was more than 20 million head. During the 3-year period 1975-1977, it held at around 30 million head. Feeding of hogs and grain production are closely linked in Hunan Province. Comparison of Figure 13 with Figure 16 shows the rise and fall of curves on both to be substantially identical. To some degree this reflects the mutual relationship between supply and demand and a chain relationship. For example, in 1974, 1.828 billion jin of feed grain was used mostly for hog raising. Estimates based on the number of head of larger livestock animals, hogs, sheep and goats in the province during 1975 show an output of more than 181.9 billion jin of all kinds of manure for the year, hog manure accounting for 76 percent of it. In addition, most areas are in the habit of spreading straw as bedding for pens, which produces barnyard manure that can provide large quantities of organic fertilizer to fields. The 33 counties (or municipalities) in



Key:

a. Area sown (10,000 mu)
b. Gross output (10,000 dan)
c. Area sown to oil-bearing crops
d. Area sown to rapeseed
e. Gross output of rapeseed

Figure 15. Curve Graph Showing Area Sown to Oil-Bearing Crops, Area Sown to Rapeseed, and Gross Output of Rapeseed for the Province



Key:

a. Numbers grown (10,000 head)
b. Numbers in inventory and removed from inventory (10,000 head)
c. Numbers grown
d. Numbers in inventory
e. Numbers removed from inventory

Figure 16. Curve Graph Showing Figures for Hogs Grown, Numbers in Inventory, and Number Removed From Inventory Over the Years for the Province

the province that produced grain yields of from 900 to 1,100 jin per mu in 1975 raised an average 0.7 head of hogs per mu or as many as more than 1.5 head per mu. For 4 years in a row, Ningxiang County had "one hog for each person," and in 1974 it had "one hog per mu." Total grain output for that county in 1975 was 59 percent higher than in 1965 and 24 percent higher than in 1970, while the number of hogs being raised increased 1.8-fold over 1965. This shows an objective law of more grain-more hogs, more manure-more grain. This has been clearly demonstrated in the development of Hunan Province's agricultural production. In 1975 the province raised a total of 31,018,800 hogs, 78 percent more than in 1965 for an annual 5.9 percent rate of increase, an average 0.6 head per mu, and an average 3.7 head per household. Eleven counties (or cities) had either one hog per person or one hog per mu. During the 2-year period 1978-1979, the number of hogs being raised rose respectively to 33,632,600 and 37,460,000 head.

Commune and brigade enterprises have developed very rapidly since 1970. Income from commune and brigade enterprises throughout the province has increased by more than 30 percent annually. In 1976, all people's communes and more than 96 percent of production brigades in the province operated a total of more than 126,000 commune and brigade enterprises (a 17-fold increase over 1958) for annual earnings of 1.5 billion yuan (a 26-fold increase over 1965), and accounting for 20 percent of gross earnings for the three-level commune system. Development of commune and brigade enterprises has played a fine role in making full use of natural resources, in improving the small-scale agricultural economy, in promoting the mechanization of agriculture, and in making the rural economy thrive. As of the end of 1979, the province had a total of 126,500 commune and brigade enterprises with earnings of more than 2.84 billion yuan or more than 33 percent of people's commune gross earnings.

To summarize the foregoing, what are the several major problems existing today in Hunan Province's agricultural production?

(1) Not Wholly Sensible Pattern of Agricultural Production

Hunan Province has a diversified and all-around agriculture made up of farming, forestry, animal husbandry, sideline occupations, and the fishing industry. In an overall sense it is "large and all-embracing," not lacking in any particular. Most communes in every prefecture and county are also "small and all-embracing," having everything. How to properly plan the relationship between unified planning, and to suit overall methods to specific situations in accordance with local realities and to properly centralize the relationship between commodity production and production for self-sufficiency in all jurisdictions is still being explored.

Hunan Province is a major grain producing region south of the Chang Jiang in which paddy rice predominates; it bears responsibility both for self-sufficiency in food and for commodity production. However, for a long time attention has been devoted to grain to the neglect of everything else. In various different places, grain has elbowed forestry aside in some cases and forests have been destroyed to clear the land for farming. In some cases,

the growing of grain has put pressure on the fishing industry as lakes have been reclaimed for the transplanting of rice seedlings. It has not been possible to take full advantage of the land or to use materials to the full. Economic diversification has proceeded slowly while grain has not been in plentiful supply either. Since the middle of the 1960's, more than 75 percent of the total wetland area has grown two crops of paddy, and within a fairly short period of time this practice has been ill-advisedly spread without regard for the region or conditions. Practice attests that it is better to grow one crop rather than two crops in high, cold mountain regions, and two crops do better than three in low-lying wet fields. Most places pay scant attention to dryland grain production or production of spring grain. They do not watch wetland and dryland crop rotation, or a combination of use and nurture of the land. There are very great variations from place to place in the farming system and planning of varieties to be grown. Farming methods go in and out of vogue, and there is equivocation. Since things are done without regard for objective laws, the natural environment's ecological balance has been destroyed, and the inherent relationship among individual agricultural sectors has been hurt giving rise to a series of vicious cycles. Some places not only use scarce mountain forests for firewood and eat scarce fish from nearby waters, but even have low standards for their grain rations, producing it at a high cost, gaining few real benefits. During the 1960's, production costs in the province amounted to about 25 percent of agricultural expenses; during the 1970's, the amount rose to more than 30 percent. In 1975 average grain yields per mu of cultivated land and average per capita grain output increased by 85 jin and 13 jin respectively as compared with 1971; however, grain and net income per capita conversely dropped by 18 jin and 6.10 yuan respectively. Even though numerous communes and brigades increased output, they did not raise earnings. In 1976, Hunan Province stood fourth in the country in total grain output and sixth in its contribution of grain to the country; however, it stood 19th in average per capita earnings distributions.

Cash crops currently account for only between 6 and 7 percent of the total planted area, and they are grown in relatively concentrated places, but some are very dispersed. Within the same major production area, a situation of disarray and confusion exists. In 1975, cotton was grown in 101 counties and cities in the province for yields averaging 68 jin per mu. Maximum yields of 144 jin per mu came from Anxian County in the lake region, and minimum yields of only 16 jin per mu came from Huayuan County in western Hunan, a nine-fold difference between highest and lowest. Taoyuan, one of the cotton production base counties in northern Hunan, planned a 162,000 mu cottonfield area for 1978 scattered over 60 communes and 95 percent of production brigades and production teams in every county where natural conditions varied. In some cases the area actually planned exceeded plan one or two fold. Some places suitable for the growing of hemp had to grow cotton. Cotton yields averaged between 20 and 40 jin per mu. In 1978, with the exception of Changde, Yiyang, and Yueyang prefectures where cottonfields were fairly concentrated, dispersed cotton growing areas accounted for 31.8 percent of the total cotton growing area but for only 22.5 percent of output, and total amount of state procurement was only 18.3 percent. During spring 1980, the province reduced some of the low yield cotton growing area

in mountain and hill regions, and increased the growing of cotton in the lake region of the northern part of the province by more than 300,000 mu. Some counties also readjusted their cottonfield patterns. This worked well in increasing cotton output. There are an additional 500,000 to 600,000 mu of dispersed low-yield cottonfields throughout the province awaiting gradual readjustment in the future.

In the development of forests, some problems exist in forest regions by lack of a clear-cut orientation and inability to suit particular trees to particular kinds of land. Mang Shan in southern Hunan is one of the province's major deciduous forest areas. For a time in the past, some of the mountain forests were cut, with fir, pine or other tree varieties being planted to replace them. The long established primeval forest ecological balance was thus destroyed in these areas, and this clearly gave rise to a shortage of water resources in mountain ravines, and some work zones even had trouble getting drinking water. The red hill region of central Hunan is a land of tea oil and tea. It is also suited to quick growing tree species such as masson pine as well as to some oil producing trees, firewood forests, and fertilizer forests. But some places have used the hills for the planting of large tracts of nothing but fir forests, and the amount of labor used during the early stages was more than 10 times as much as is required to plant firs in mountain regions. The total biomass of fir trees near mature forests is half as great as that of fir trees of the same age in mountain regions. The percentage of biomass of dried fir timber from hills is low but the percentage of stem and leaf biomass is high and the timber output rate is low, which shows that the growing of firs on hills is generally not as good as growing them on mountains. Northwestern Hunan is an optimum ecologically suitable area for economic forests such as tung and Chinese tallow trees, and it is also an important tung oil base in the country. For various historical reasons, this region's tung oil output has never revived to the maximum prewar level.

(2) Wide Disparity in Proportions Among Sectors

Output value from farming has always held an overwhelmingly predominant position in the gross output value from farming, forestry, animal husbandry, sideline occupations, and fisheries, all other sectors accounting for only small proportions of output value. This has reflected the clear lack of diversification of the economic structure in agriculture, and the very great proportional imbalance within it.

During the 10-year period from 1966-1975, generally the following situation obtained with regard to the gross output value of agriculture for the province: Farming accounted for 67 percent, forestry for 4 percent, animal husbandry for 13.5 percent, sideline occupations for 14.5 percent, and the fishing industry for about 1 percent. In recent years output value of both farming and animal husbandry have risen slightly while it has declined proportionally for the others, the disparity running from several fold to more than 10 fold.

Within farming, output value of grain crops has consistently held a commanding position. During the aforementioned 10-year period, grain accounted for 50.8 percent of the output value of farming while other crops (including soybeans, melons and vegetables, green manure, tea, mulberry, and fruit) collectively accounted for 11.3 percent. Cash crops accounted for only 4.9 percent. In recent years, cash crops have been planted on only 9 percent of cultivated land and have accounted for only 9.8 percent of gross output value, both of which are below the national average. The percentage of commodities has generally been only about 65 percent of output except for a small number [of commodities] that has been higher.

Hunan has vast mountainlands, but insufficient attention has been given their use. The kinds of trees in forested areas are of single kinds, and trees in the same forest are at various ages of development. No improvement has been made to most sparsely treed or remnant forests, or to scrub forests. Many barren mountains suitable for afforestation and many blank spots in the four besides [beside streams, roads, villages, and houses] have not been planted to trees, and the red hill lands even more obviously lack vegetation cover. As a result of the gross overcutting of forest trees, the number of counties in the province that produce timber has dropped from 88 during the period immediately following liberation to the present 68, and the number of counties that supply timber to the country has declined from 61 to 43. The number of counties simply selling timber has increased from 12 to 34. As a result forestry production has fallen into an abnormal state in which felling exceeds afforestation.

The mainstay of animal husbandry production is the raising of hogs. Local hog species are numerous and complex, and most are characteristically very fatty or are a mixture of fat and flesh and of little significance in foreign trade. In addition, hog output is inextricably bound up with grain production, so the raising of hogs is clearly governed by fluctuations in the availability of grain. The province has a considerable amount of grassland resources and plentiful crop stalks and stems that are not used to the full. There has not been enough attention to developing grass eating livestock such as cows, sheep and goats, and rabbits, and the pace of animal husbandry production has not been fast.

In commune and brigade industrial sideline production, insufficient attention has been given to the suiting of general methods to local situations, to acquiring raw materials locally, to the processing of products, and to using things in multiple ways. Numerous contradictions exist between farming and sideline occupations, and among production, supply, and marketing. Earnings are low; accumulations are few; and a strong foundation does not yet exist.

In the fishing industry, the catching of fish is on the decline while the breeding of fish is on the rise. Nevertheless, water surfaces that could be used are not being used to the full; intensive use of water surfaces is even less; and yields per unit of area are low and inconsistent.

(3) Substantial Fluctuations From One Year to Another

During the 30 years since the founding of the nation, the province's agricultural production has risen in a curve containing peaks and troughs. It has fluctuated up and down from one year to another and from one season to another within the same year instead of maintaining steady increases.

Numerous flood and drought disasters have had a widespread effect. Incomplete statistical data for the past 30 years show an average 3.21 million mu, or 8 percent of the province's wetland area, affected by floods annually causing a 470 million jin decrease in grain output. An average 8.15 million mu, or 20 percent of the wetland area, has been affected by drought annually resulting in a 1.62 billion jin reduction in output. Taken together, the two kinds of disasters annually afflict an 11.36 million mu area, with about 50 percent of this area being a disaster area. Generally speaking, there is one major drought every 3 years and one major flood every 5 years causing a 7 to 8 percent reduction in total grain output for each year (figured in terms of 1976 output), the loss running to as much as 5.3 billion jin in most serious years. (Table 30)

Table 30. Effects of Serious Floods and Droughts in Hunan

(a) 灾类 / (e) 损失 / 项目 (h)	(b) 水灾		(c) 旱灾		(d) 合计	
	(f) 面积 (万亩)	(g) 减产 (亿斤)	(f) 面积 (万亩)	(g) 减产 (亿斤)	(f) 面积 (万亩)	(g) 减产 (亿斤)
(i) 平均	321	4.76	815	16.2	1136	20.8
(j) 最高	1196	44.03	2981	52.78	3081	53.33
(k) 年份	1954	1954	1960	1971	1960	1971

Key:

a. Kind of disaster
b. Flood
c. Drought
d. Total
e. Damage
f. Area (10,000 mu)
g. Reduction in output (100 million jin)
h. Particulars
i. Average
j. Maximum
k. Year

The "three cold spells" (the spring cold spell during March and April, low temperatures during May, and the cold dew winds of September) each year, plus disease and insect damage frequently cause grievous losses for agricultural production. Annually about 100 million jin of early rice seeds rot, and during the particularly cold spring of 1972, more than 300 million jin rotted. Low temperatures during May hurt normal growth and development of early rice. The first powerful cold wave intrusion of May 1959 caused serious damage to the early rice whose young panicles were then in the stage of differentiation and booting, causing a loss of 200 jin per mu. The cold dew winds following the onset of autumn also frequently cause deterioration of physiological functions in double crop late rice, which leads to an increase in the number of empty glumes and a decrease in yields. Disease and

insect damage each year cause a 1 to 1.5 billion jin loss in paddy rice output alone. Thanks to natural causes and insufficient human attention, "three lows" result everywhere, namely low yields from dryland grain, low yields from spring grain, and low yields from late crop rice.

In many places forests have been destroyed by the reckless clearing of land to expand farming. In 1958, 27.7 percent of the province's total land area was eroded, 9 percent of it seriously. Despite efforts to heal the damage, the scars still remain and the damage continues. Each year 170 million tons of topsoil is washed away throughout the province. This is the gross weight of the cultivated soil layer from 800,000 mu of land. During the 11-year period 1967-1977, the four rivers annually carried an average of about 39.17 million tons of silt into Dongting Hu, a 34.2 percent increase as compared with the previous 11 years. Each year, on the average, 165 million tons of silt enters the Chang Jiang at the Three Gorges, causing an increase of more than 60,000 mu of delta deposit each year at Dongting Hu. This silting plus man's reclamation of land from the lake resulted in the lake covering an area of only 2,740 square kilometers in 1977. This was a 37 percent reduction in area and a 39.2 percent reduction in water storage capacity from 1949. During late summer and early autumn, the rivers reach flood crest and the lake region becomes prone to flood and waterlogging calamities. As a result of silting, 12 large reservoirs in the province (including the Tuoxi and Baiyutan reservoirs) have had their capacity reduced from the designed 7.137 billion cubic meters to 114 million cubic meters. Each year one-sixth of the province's wetland area becomes covered with silt and yellow mud. Today 36 percent of cultivated land is unable to deliver a harvest despite drought or flooding.

In Hunan Province, flooding and drought are the principal natural disasters, which explains the serious degree to which the natural environment has been damaged. In addition, lack of farmland capital construction and weakness in technical measures to withstand disasters has meant even less ability to withstand drought and floods. Statistics show that in the 30 years since liberation, grain output increased in 19 and decreased in 7 fluctuating around 3 and 4 billion jin. Cotton output increased in only 9 years and decreased in 13, rising and falling around the 300,000 to 400,000 dan mark.

(4) Marked Differences From One Region to Another

The province's 56 counties (or cities) that lie in mountain or semimountain regions cover 60 percent of the province's total land area and contain about 43 percent of its cultivated land. The 49 counties (cities and towns) in hill and flatland areas cover 40 percent of the province's total land area and contain 57 percent of its total cultivated land.

In 1979, the province's grain yields averaged 1,011 jin per mu, while yields in mountain regions were about 120 jin per mu less than the provincial average. In four counties yields averaged less than 700 jin. In Qianyang Prefecture and in the autonomous zhou in western Hunan, grain yields averaged only 570 jin and net income averaged only 82.6 yuan per capita. This was 30 jin and 9.70 yuan lower respectively than the provincial average. In 6.4

percent of production teams, grain yields averaged less than 400 jin per capita, and in 7.2 percent of production teams average net income was less than 50 yuan. During the 5-year period 1970-1974, the province's marketable grain rate averaged better than 20 percent, while it was about 17 percent for mountain regions. The state had to sell grain back to production teams in some counties after state purchase quotas had been fulfilled, so their net contribution was slight.

Comparison of grain, cotton, and hog production for individual prefectures in 1979 (Table 31) shows central Hunan and most parts of northern Hunan holding a leading position, while western Hunan and the mountain regions of southern Hunan lagged behind. This is a damaging legacy resulting from the historically undiversified structure of the agricultural economy that does not permit full benefit to be derived from local advantages.

Not only is there a disparity among large regions, but even within the same region outputs from fields and crops are very unbalanced. Between one county and another, there is a one or two fold difference in some units, and between one production team and another there may be a three or four fold difference. In 1979, 15.56 percent of all counties had grain yields below 800 jin per mu, and 4.44 percent had grain yields below 700 jin. Production teams with a net income of more than 150 yuan number only 4.75 percent of all production teams, and 26.18 percent had net incomes of less than 70 yuan. Clearly the ratio of low yield impoverished communes and brigades is not small, and development is very balanced between one prefecture and another.

Table 31. Comparison of Grain, Cotton, and Hog Output for All Prefectures in Hunan Province

(a) 地区	(t) 农业人口比重 (z) 占全省 (%)	(aa) 排队	(u) 粮食总产比重 (z) 占全省 %	(aa) 排队	(v) 棉花总产比重 (z) 占全省 %	(aa) 排队	(w) 牲猪饲养数比重 (z) 占全省 %	(aa) 排队	(x) 牲猪存栏数比重 (z) 占全省 %	(aa) 排队	(y) 平均每个农业人口生产的 (ab) 粮食 (ae) 斤数	(aa) 排队	(ac) 棉花 (ae) 斤数	(aa) 排队	(ad) 牲猪饲养 (af) 头数	(aa) 排队	(ag) 总产量或总头数比上年增、减% (ab) 粮食	(ac) 棉花	(ad) 牲猪饲养	(ah) 牲猪存栏
(b) 全省	100		100								961		4.06		0.81		6.24	24.05	8.92	9.03
(c) 韶山	0.17	17	0.20	17	0.06	14	0.23	17	0.21	17	1145	2	1.38	6	1.08	3	2.25	22.22	6.18	24.16
(d) 湘潭	9.89	3	11.02	2	3.20	4	9.86	2	10.28	3	1070	6	1.31	7	0.81	9	5.16	-14.29	5.88	8.35
(e) 岳阳	8.03	7	9.04	5	19.36	2	8.64	6	8.21	6	1081	4	9.79	2	0.87	6	7.86	26.80	6.12	5.61
(f) 益阳	9.54	4	10.35	4	11.59	3	9.84	3	9.71	5	1043	7	4.93	3	0.84	8	6.89	25.84	7.86	11.16
(g) 常德	11.50	1	13.77	1	53.35	1	11.94	1	10.48	2	1151	1	18.83	1	0.84	8	8.11	42.43	8.43	12.35
(h) 涟源	9.32	5	7.78	6	1.02	11	9.61	4	10.08	4	802	13	0.45	13	0.84	8	7.37	-21.31	8.90	12.00
(i) 邵阳	7.59	8	6.50	9	1.26	8	7.61	7	7.59	7	823	12	0.67	10	0.81	9	2.13	-22.88	11.28	16.46
(j) 衡阳	10.17	2	10.71	3	3.00	5	9.53	5	10.98	1	1013	8	1.20	9	0.76	11	6.27	-14.31	5.35	-0.41
(k) 郴州	8.59	6	7.48	7	1.41	7	6.85	9	7.33	9	836	11	0.67	10	0.65	14	1.21	-8.31	4.33	0.01
(l) 零陵	7.13	10	6.43	10	2.12	6	6.86	8	7.43	8	868	9	1.21	8	0.78	10	1.28	-9.34	9.31	5.05
(m) 黔阳	7.40	9	6.55	8	1.13	10	6.50	10	6.50	10	851	10	0.62	11	0.71	13	4.62	2.93	7.19	6.00
(n) 自治州	5.24	11	4.36	11	0.79	12	4.64	12	3.98	12	780	14	0.61	12	0.72	12	10.92	-9.76	18.07	22.92
(o) 长沙市	3.23	12	3.80	12	1.15	9	5.36	11	4.52	11	1131	3	1.45	5	1.35	1	13.76	-10.37	33.31	21.58
(p) 株洲市	1.18	13	1.32	13	0.53	13	1.24	13	1.30	13	1075	5	1.84	4	0.85	7	10.38	-21.88	0.74	0.16
(q) 衡阳市	0.29	15	0.22	15	—	—	0.35	16	0.42	16	736	15	—	—	0.96	4	6.38	—	-27.65	-46.33
(r) 湘潭市	0.29	16	0.21	16	—	—	0.41	15	0.46	15	690	16	—	—	1.16	2	9.52	—	-35.52	-46.96
(s) 邵阳市	0.44	14	0.26	14	0.02	15	0.52	14	0.52	14	557	17	0.15	14	0.94	5	4.59	-66.67	-26.55	-40.39

(ai) 注：韶山区现已划属湘潭县。

[Key on following page]

Key:

a. Prefecture
b. Whole province
c. Shaoshan
d. Xiangtan
e. Yueyang
f. Yiyang
g. Changde
h. Lianyuan
i. Shaoyang
j. Hengyang
k. Chenzhou
l. Lingling
m. Qianyang
n. Autonomous zhou
o. Changsha City
p. Zhuzhou City
q. Hengyang City
r. Xiangtan City
s. Shaoyang City
t. Proportion of agricultural population
u. Proportion of gross grain output
v. Proportion of gross cotton output
w. Proportion of total number of hogs raised
x. Proportion of total number of hogs in inventory
y. Average output per capita of agricultural population
z. Percent of province as a whole
aa. Team ranking
ab. Grain
ac. Cotton
ad. Hogs raised
ae. Number of jin
af. Number of head
ag. Percent increase or decrease over previous year in gross output or total number of head
ah. Hogs in inventory
ai. Note: Shaoshan Prefecture is now a part of Xiangtan County.

Fourth Section. Direction and Avenues of Development of Agricultural Production

Hunan Province has made unprecedented achievements in agricultural production in the course of building the four socialist modernizations, and has laid a fine foundation for future development. Nevertheless, quite a few contradictions and weak spots still exist in the speed of development of agricultural production, in increasing quantities of agricultural production and raising labor productivity rates, and in how to concert development of the entire national economy with the people's ever increasing needs. The crux of the problem lies in the still very low level of agricultural modernization, in the lack of thoroughgoing change in the traditionally undiversified structure of the agricultural economy, in the insufficient clarification of the characteristics of major resources and of their composition and distinctions, and in the failure to establish a stable agricultural ecological system. These situations are facing a new historical turning point, requiring the elimination of disadvantages and the promotion of advantages, and the carrying out of a new transformation and development.

1. Strategic Program for Development of Agricultural Production

Agriculture is the foundation of the national economy, and high speed development of agriculture is a fundamental condition for guaranteeing realization of the four modernizations. Under guidance of a program of simultaneous development of farming, forestry, animal husbandry, sideline occupations and forestry, and of "taking grain as the key link, all-around development, suiting of general methods to specific situations, and appropriate centralization," it is necessary to proceed from the province's existing foundation and characteristics. It is necessary to carry out a combination of farming, forestry, and animal husbandry in a rational pattern; to continue a firm grip on grain production, vigorously develop economic diversification, build various kinds of commodity production bases and intensify technical transformation; to engage in intensive agriculture directing main efforts toward yields per unit of area, to increase output of products, and to raise labor productivity rates.

Building an Agricultural System That Integrates Farming, Forestry, and Animal Husbandry: Mountains and hills rise and fall and rivers crisscross Hunan Province. From large areas to small tracts, a three-dimensional pattern of mountains, water, and fields exists everywhere providing objective conditions for integrated development of farming, forestry, and animal husbandry. The essential links are provided for using forests to protect farms, animal husbandry to advance agriculture, agriculture to foster sideline occupations, and sideline occupations to support agriculture. Only through the integration of farming, forestry, and animal husbandry to advance each other, and the creation and maintenance of an ecologically balanced natural environment will it be possible to attain green mountains and limpid waters, lush forests and plentiful grain, and the thriving of the six livestock animals. By continuing along these lines, as a result of conversion of biological energy and the material cycle, it will be possible to establish a normally revolving "food chain" and preserve the ecological balance. This would not only help

regulate and cleanse the natural environment, but once output of various products was plentiful, and particularly with development of animal husbandry and fisheries as well as increases in other animal and plant foods, the structure of the people's diet would improve, and both market supply and needs of the national economy could be assured.

Firm Grip on Food Production and Active Development of Economic Diversification: Hunan Province's climate is temperate and humid, and it has a long growing season. Both north and south are a transitional zone for natural conditions. Historically the province has been one of the major paddy producing areas of the south, and it is also suited as well for the growing of economically diversified crops, and for the growing and introduction of forests, tea, and citrus fruits. All parts of the province contain abundant forests, water conservancy (power), and mineral resources. Thus, energetic development of economic diversification both fits in with objective conditions, and is part of the basic strategy for agriculture. Firm grip must continue to be maintained on grain production. Mountain regions must grow both paddy rice and dryland grain crops to attain self-sufficiency with some surplus, and plains and hill regions should provide more marketable grain. There must be suitable expansion of the cash crop growing area, with emphasis on development of rapeseed, citrus fruit, tea, and hemp production, vigorous increase in outputs of cotton, sugarcane, and flue-cured tobacco, and active development of silkworm mulberry, vegetable, peanut, and medicinal herb production. Full use must be made of mountainlands, with major efforts in forestry and afforestation, increase in timber reserves, serious attention to development of woody edible oil plants, a combination of felling and replanting, and intensification of multiple uses of forest products. Simultaneous with development of hog and poultry production, use must be made of grassland resources, of crops stalks and stems, and of other fodders for energetic development of grass-eating animals such as cattle, sheep and goats, and rabbits. It is necessary to increase the water surface utilization rate, to protect aquatic product resources, to accelerate fishing industry production, and to increase output of aquatic products. There must be rational development and use of local natural resources, adaptation of general methods to local circumstances for development of commune and brigade enterprises, good performance in processing and multiple uses of agricultural sideline products, strengthening of links among agriculture, industry, and commerce, expansion of capital accumulation, and improvement of agricultural reproduction capabilities.

Full and Rational Tapping of Soil Potential for Increased Yields: Hunan Province has a large population relative to available land. There is only 1 mu of land per capita, and the saturation point has been substantially reached in the reclamation of all land suitable for agriculture. Average yields of farm crops in terms of area sown in 1979 were 518.5 jin per mu for grain including 592 jin per mu of paddy, and 243 jin per mu of grains other than wheat and rice. For cash crops, yields were 78 jin per mu for cotton, 100 jin per mu for rapeseed, 186 jin per mu for ramie, and 6,164 jin per mu for sugarcane. Farm crop yields per unit of area are not high, and some current yields vary as much as two or three fold, showing that the potential for increased yields is still very great. Thus, the farming

industry should not seek to clear new land to increase the cultivated area or to reclaim lakes to make fields, but should strive instead to stabilize and build up existing cultivated land, adopt intensive farming methods, and take the path of primarily increasing yields and gross output.

The province's mountainlands account for half its total area, and mountains and hills together cover 70 percent of the total area, or an average of about 4 mu per capita. Forest reserve figures for the province for 1977 averaged 2.13 cubic meters per mu, which was only 40 percent of the national average, placing Hunan in 20th position in the country. Within timber forests, reserves of Chinese fir average 2.39 cubic meters per mu. However, at the Taowei work area on Jianghua Forest Farm, reserves average 15 cubic meters per mu and as much as 32.7 cubic meters per mu for a 470,000 mu Chinese fir area. At Guangping Commune in Huitong County, Chinese fir reserves are 30 cubic meters per mu. Clearly the difference between high and low is great. There are 50.27 million mu of barren mountains and slash lands in the province that are urgently in need of afforestation, and there are 27.63 million mu of vestigial and scrub tree forests currently requiring improvement. For the province as a whole, a very great potential exists for improving both timber reserves per unit of area and total reserves. In addition, potential also exists for improving and developing current removal from inventory rates, dressing rates, egg production rates, and yields per unit from the raising of livestock and poultry and the breeding of aquatic products.

Making the Most of Local Advantages and Instituting Sensible Patterns: Elevation of the terrain east and west varies from 300 to 500 meters, and there is also a difference of 5 degrees latitude between north and south. There is a rather clear regionality in the province's natural conditions, characteristics of resources, historical traditions, economic foundation, and kinds and present levels of agricultural production. For example, west of a line through the eastern foothills of Xuefeng Shan, single crop paddy predominates, fairly little dryland grain is grown, and grass-eating poultry are fairly numerous. East of the line the double crop paddy area is widespread, the marketable product rate is high, large numbers of hogs are raised, and cash crops are fairly great. Forestlands are found mostly in surrounding mountain regions. Western and southern Hunan have 87.5 percent of the province's total timber reserves, and produce 91.2 percent of its tung oil and 58 percent of its tea oil output. Various kinds of vegetation cover, distribution of superior tree varieties, and restrictions imposed by water, heat, terrain, and soil mother materials are obvious. In order to develop natural production and socioeconomic potential fully and rationally, it is necessary to take into account objective laws governing agricultural production conditions and regional differences, to suit general methods to local circumstances, to have a rational pattern of production, and to study and determine both the structure of agricultural production and individual proportions of that structure. Unsuitable existing production patterns must be gradually readjusted. For example the growing of cotton must be shifted northward and the growing of sugarcane shifted southward. Locations of forest areas should be set, and expanses set aside for animal husbandry. In Hunan Province, neither farming nor breeding industries should be overly

concentrated; however, concentration should be appropriate for different production sectors and suitable ecological conditions for them. All sorts of commodity production bases should be established, and a foundation laid within definite areas for gradual regionalization and specialization of production.

2. Principal Avenues for Development of Agricultural Production

(1) Readjustment of Patterns and Establishment of Commodity Production Bases

A main direction of attack should be set for different areas under the guiding premises of an integration of farming, forestry and animal husbandry, and centralized planning. Land suited to farming should be used for farming; land suited to forestry should be used for forestry; land suited to animal husbandry should be used for animal husbandry; and land suited to fisheries should be used for fisheries. A single industry should predominate, but there should be economic diversification as well, with all relevant resources used to the full so that they will be mutually promoting and complement each other. Existing agricultural patterns should be readjusted in a planned way, and there should be an adaptation of general methods to specific situations for establishment of a group of commodity production bases. As a result, some production systems will enjoy a preferential position, and there will be appropriate concentration to help achieve equitable use of various agricultural resources, to ease administration and management and the promotion of new techniques, thereby further increasing output and quantities of goods.

I. Grain and Cash Crop Production Bases

(I) Marketable Grain Production Bases: According to a central government directive, Hunan Province should make major efforts to build a marketable grain production base in the Dongting Hu region. Other flatland and hill regions should actively create conditions for more grain production in an effort to contribute more to the country.

Ever since 1971, Hunan Province's annual state purchase quota has been more than 5.8 billion jin, and in 1979, the whole province provided 8.756 billion jin of marketable grain for a 17.5 percent commodity rate (Table 32).

Standards for Marketable Grain Base Counties: One general requirement for a marketable grain base county is ability to provide more than 100 million jin of marketable grain and a commodity rate of 20 percent. On the basis of an average 1.5 mu of cultivated land per capita of agricultural population providing 200 jin or more of marketable grain, Hunan Province has frequently designated 19 or 20 marketable grain counties that provide about 57 percent of the province's total marketable grain. A look at the state grain procurement situation in the province for 1974 and 1975 shows 53 of 100 counties and cities in the province as having provided less than 50 million jin, 25 counties as having provided between 50 million and 100 million jin, and 22 counties as having provided more than 100 million jin. Counties with a combination of local circumstances and an agricultural foundation providing fairly good conditions for developing grain bases number 38. (Table 33)

Table 32. Grain Contributions to the Country by Individual Prefectures in Hunan Province

	(a) 总产量 (亿斤)	(b) 贡献数		(e) 占全省商品粮比重(%)
		(c) 合计 (亿斤)	(d) 占总产 %	
(f) 全省	443.63	87.56	19.74	100
(g) 韶山	0.91	0.17	18.60	0.19
(h) 湘潭	48.88	10.52	21.52	12.01
(i) 岳阳	40.08	9.38	23.40	10.71
(j) 益阳	45.92	9.50	20.69	10.85
(k) 常德	61.11	17.35	28.39	19.81
(l) 邵阳	28.82	4.45	15.44	5.08
(m) 涟源	34.51	3.83	11.10	4.37
(n) 衡阳	47.53	9.79	20.60	11.18
(o) 郴州	33.17	5.54	16.70	6.33
(p) 零陵	28.55	4.46	15.62	5.09
(q) 黔阳	29.06	5.16	17.76	5.89
(r) 湘西自治州	19.34	2.49	12.87	2.84
(s) 长沙市	16.84	3.26	19.36	3.72
(t) 株洲市	5.85	1.25	21.37	1.43
(u) 湘潭市	0.92	0.10	10.87	0.11
(v) 衡阳市	1.00	0.21	21.06	0.24
(w) 邵阳市	1.14	0.09	7.89	0.10

Note: Figures for grain contributed do not include 38.05 million jin contributed by state-owned farms.

Key:

a. Gross amount (100 million jin)
b. Amount contributed
c. Total (100 million jin)
d. Percent of total
e. Percent of marketable grain for whole province
f. Whole province
g. Shaoshan
h. Xiangtan
i. Yueyang
j. Yiyang
k. Changde
l. Shaoyang
m. Lianyuan
n. Hengyang
o. Chenzhou
p. Lingling
q. Qianyang
r. Western Hunan autonomous region
s. Changsha City
t. Zhuzhou City
u. Xiangtan City
v. Hengyang City
w. Shaoyang City

Table 33. Basic Situation in 38 Counties

		(a) 合计	(b) 湘北	(c) 湘中、东	(d) 湘南	(e) 湘西
(f) 县数		38	14	12	7	5
(g) 农业人口	(h) 合计(万人)	2445.03	846.43	967.09	373.69	257.82
	(i) 占全数 %	54.71	18.94	21.64	8.36	5.77
(j) 耕地	(k) 合计(万亩)	2938.60	1172.11	1061.31	428.43	276.75
	(l) 占全省(%)	56.59	22.57	20.44	8.25	5.33
(m) 其中：旱涝保收农田	(k) 合计(万亩)	1924.44	826.97	711.15	258.3	128.02
	(l) 占全省(%)	64.34	27.65	23.77	8.64	4.28
(n) 粮食作物占地	(k) 合计(万亩)	2526.69	946.29	946.31	395.16	238.93
	(l) 占全省 %	56.98	21.34	21.34	8.91	5.39
(o) 粮食总产	(p) 合计(万斤)	2219014	850522	874242	314263	182987
	(l) 占全省(%)	60.55	23.21	23.77	8.58	4.99
(q) 粮食亩产		878	899	921	795	766
(r) 商品粮	(p) 合计(万斤)	474436	233376	160641	48976	31452
	(l) 占全省(%)	70.79	34.82	23.97	7.31	4.96
(s) 商品率	(t) 平均 %	21.38	27.44	18.44	15.58	17.19
	(u) >30%的县数	4	4	0	0	0
	(v) 25-30%的县数	8	7	0	0	1
	(w) 20-25%的县数	12	2	5	4	1
	(x) 15-20%的县数	14	1	7	3	3

Key:

a. Total
b. Northern Hunan
c. Central and eastern Hunan
d. Southern Hunan
e. Western Hunan
f. Number of counties
g. Agricultural population
h. Total (10,000 people)
i. Percentage of total
j. Cultivated land
k. Total (10,000 mu)
l. Percentage of the province as a whole
m. Including: farmland from which a harvest can be assured despite flood or drought
n. Land occupied by grain crops
o. Total grain output
p. Total (10,000 jin)
q. Grain yields per mu
r. Marketable grain
s. Marketable rate
t. Average (%)
u. Number of counties >30 percent
v. Number of counties with 25-30 percent
w. Number of counties with 20-25 percent
x. Number of counties with 15-20 percent

(1) Northern Hunan: Changde, Lixian, Taoyuan, and Anxian counties (each producing more than 200 million jin. Based on state grain procurement figures for 1974-1975. The same applies subsequently); Nanxian, Yuanjiang, Huarong, Hanshou, and Yiyang (each producing more than 150 million jin); Xiangyin, Yueyang, and Linli (more than 100 million jin); and Linxiang and Miluo (80-90 million jin). The foregoing 14 counties were originally designated marketable grain counties. They have a common feature in that they are largely in the Dongting Hu plain zone where soil is fertile, water plentiful, garden style agriculture carried out over a fairly wide area, and average amount of cultivated land per capita is relatively great, suiting the areas to further consolidation and improvement.

(2) Central and eastern Hunan: Changsha and Ningxiang (between 190 and more than 200 million jin); Xiangtan, Liuyang, Youxian, Hengnan, Hengyang, Xiangxiang, and Pingjiang (more than 100 million jin); Taojiang, Chaling, and Hengdong (more than 50 million jin). Changsha, Ningxiang, Xiangtan, and Hengdong were originally designated marketable grain counties. Most of these counties are in hills and basins where workforces are abundant and the degree of intensivity of agriculture is fairly high. However, population is fairly dense and there is little surplus land. Increased output will depend on tapping potential for further increases in yields per unit of area.

(3) Southern Hunan: Lingling (more than 100 million jin); Laiyang, Dongan, Chenxian, Changning, Zixing, and Qiyang (more than 50 million jin). The first two counties were originally designated grain counties. This region is located in mountainlands and hills interspersed with basins. Land, heat and water resources are good, but more fertilization and building of water conservancy is required in an effort to increase yields per unit of area from land already under cultivation.

(4) Western Hunan: The five counties of Shupu, Huaihua, Qianyang, Longhui, and Dongkou (more than 50 million jin). These counties are mountain, hill, and basin lands on both sides of the mid section of Xuefeng Shan where farmland capital construction and improved farming techniques are required.

(II) Cash Crop and Mulberry, Tea, and Citrus Bases: Cash crops are very much selective with regard to natural conditions. In planning varieties to be grown, general circumstances must be suited to specific locales and the main emphasis highlighted. In order to improve output and marketable product rates, firm attention must be given to the building of bases. The following matters must be properly handled in doing this: (1) The relationship of parts to the whole. Following rational readjustments, to the maximum extent possible various cash crops must be placed where natural conditions are best, where people are accustomed to growing them, where yields per mu are high, where quality is good, and where transportation is relatively convenient. Certain counties should be designated key points for development of one or two, or of two or three cash crops for gradual building of production bases that produce consistently high outputs. This will help in the strengthening of leadership, in the accumulation of experiences, in development of production, in increasing marketable product rates, and in assuring fulfillment of state plans. (2) Relationship between grain and cash crops. Grain output

must be increased and economic diversification must be developed as well. The two are positively not mutually exclusive, but rather are complementary and mutually promoting. Economic diversification and using resources in multiple ways is a broad avenue that requires people to exert utmost efforts, the land to yield maximum benefits, and materials to be used to the full. They require rational readjustment of crop patterns and satisfactory solution to conflicts between grain output and economic diversification in use of land, workforces, capital, and fertilizer. It requires full use of resources, taking the road of high yields from both, and all-out efforts to build the province's cash crop production into centralized continuous tract commodity bases. (3) Each jurisdiction is also to produce for self-sufficiency, linking production of marketable products with production for self-sufficiency to increase outputs of more products. (4) In concerting long-range and current goals, it is necessary both to develop vigorously cash crops that provide benefits in the current year and to develop actively cash crops that provide benefits for many years to come; to actively revive and develop certain traditional goods, and to develop new varieties in a planned way to bring about a combination of the long-range and the short-range, use the short-range to nurture the long-range, with rational planning so that the two advance each other.

The lake region should develop fiber crops such as cotton, hemp, and silk for the most part under imperative of state plans and on the basis of natural conditions in all parts of the region as well as of existing production bases there. Southern Hunan should gradually be built up as sugarcane and flue-cured tobacco bases for the province, with vigorous efforts going into development of ramie, citrus fruit, and tea production. Western Hunan should emphasize development of fruit and ramie production. Central and eastern Hunan should consolidate and improve existing tea plantations and develop the growing of citrus fruit and silkworm mulberry. The province's state-owned farms should build cotton, edible oil, and sugar production bases as quickly as possible. Suburban areas and places near industrial and mining centers should actively develop the growing of nonstaple foods such as vegetables and fruit. All counties should also suit general methods to specific circumstances to take firm grip on production of Category I and Category II staple cash crops.

1. Cotton: The province's cottonfields should be concentrated in its northern prefectures. (1) Soil and sunshine conditions are rather good in the lower reaches of the four rivers and on the lake plain. Further work should be done on farmland capital construction, on perfection of the drainage and irrigation systems, and on upgrading standards for growing cotton scientifically. (2) The province has 15 counties growing cotton on more than 50,000 mu of land, which is 59.2 percent of the province's total cottonfield area. Proper concentration of cottonfields with a strengthening of administration and management would help raise both yields per unit of area and gross output. In years of normal harvests, the lake region should account for about 70 percent of the province's gross output of cotton. (3) At the present stage, some cottonfields in the province's autonomous zhou, as well as in central and southern Hunan, are being shifted to the growing of other crops, and more cotton is being grown in the lake region. Emphasis must be placed on

the building of cotton growing areas in Lixian, Changde, Linli, Shimen, Cili, Anxiang, Hanshou, Nanxian, Taoyuan, Yuanjiang, Yiyang, Huarong, Yueyang, and Linxiang counties, and at Qianlianghu and Chunshan farms, as well as in Ningxiang, Lingling, Laiyang, Hengnan, and Hengyang, which are 21 major cotton growing counties and farms. Future readjustments must also be made in the five rear ranking counties where the cotton growing area is dispersed and produces low yields. Yuanjiang should devote itself mostly to China grass production, and should build an additional group of key cotton producing counties of more than 100,000 mu, should strive to keep the cotton growing acreage stable, and should concentrate efforts on increasing yields per unit of area and on improving quality.

2. Oil-bearing crops: Rape is one of the province's principal oil-bearing crops, accounting for 22 percent of the province's edible oil in normal years. As a winter crop, and particularly as part of a three crop system of rape-rice-rice in paddyfield areas, the growing of rape not only increases the multiple cropping index, but also helps other rotated crops to keep ahead of the farming season, to combine use and nurture of the land, to build soil fertility, and to promote grain production. Present crop patterns may be used as a basis for planning a 16-20 percent expansion of the growing of rape on cultivated land in all parts of the province. Northern Hunan, central Hunan, and other hill and basin areas should be locations for building relatively concentrated continuous tract rape production areas.

Peanut growing should be developed on the existing foundation in the 15 counties of Anhua, Xinhua, Lianyuan, Shaodong, Shaoyang, Longhui, Dongkou, Wugang, Xinning, Lingling, Daoxian, Ningyuan, Jiangyong, Dayong, and Yongshun, most of which are in the red soil hill dryland region of the upper reaches of the Zi Shui. Sesame growing should be concentrated mostly in Changde, Yiyang, and Yueyang prefectures in northern Hunan.

3. Hemp: Hunan has a fairly long history in the growing of ramie, and since liberation it has also developed production of jute and ambari hemp. Increase in ramie production can expand raw materials for the textile industry. Ramie output from Yuanjiang County, the area in which ramie production is concentrated, amounts to more than 58 percent of ramie output for the province as a whole. Emphasis should be given to construction of six base counties in Yuanjiang, Hanshou, Yizhang, Dayong, Fenghuang and Jiahe counties, and to appropriate expansion of some bases.

Areas around the lake are major producing areas for jute and ambari hemp. This includes Huarong, Xiangyin, Nanxian, and Hanshou counties, which are key ones for development of jute and ambari hemp production. In years of normal harvest, these four counties produce about 90 percent of the province's ambari hemp and jute output. Other lake region counties should also use some sandy soil for suitable expansion of hemp production.

4. Sugarcane: Major sugarcane producing areas should be located in Hunan's southern prefectures where heat, soil, and water conditions, and the experience of the masses in growing sugarcane are right. Jiangyong, Daoxian, Lingling, Ningyuan, Chenxian, Yizhang, Linwu, and Qiyang counties, and the

suburbs of Shaoyang are suited to the growing of sugarcane. It is also grown slightly northward in Liuyang, Lixian, Hanshou, Huayuan, and Shupu counties. The Qianlianghu, Quyuan, Datonghu, Beizhouzi, Jinpen, Chapanzhou, Qianshanhong, and Xidongting farms in the lake region should also grow a certain amount insofar as sugar refinery capacity permits since they are located near existing sugar refineries. Daoxian, Jiangyong, and Ningyuan counties are also suited for future development of sugarcane production.

5. Flue-cured tobacco: Production of flue-cured tobacco is centered in southern and west-central prefectures of Hunan Province. Production has developed in southern Hunan since liberation. Quality is good, with Jianghua and Guiyang counties growing superior quality flue-cured tobacco from which A and B grade cigarettes are made. In recent years Guiyang County has used cold waterlogged deep muddy fields to grow flue-cured tobacco and hybrid rice as successive crops, harvesting bumper crops of both grain and tobacco. This has also played a role in improving low yield fields. Flue-cured tobacco bases should be built in Guiyang, Laiyang, Chenxian, Xintian, Ningyuan, Jianghua, and Lanshan counties, with proper expansion of acreage and active improvement in both yields per unit of area and quality.

6. Silkworm mulberry: New expansion in the province's growing of silkworm mulberry began during the 1970's, but the overall speed of development has been slow, and conflicts between supply and demand prominent. Existing bases and production conditions continue to make the lake area and north central Hunan suitable areas for silkworm mulberry. Twelve counties, namely Huarong, Liuyang, Yueyang, Changde, Lixian, Xiangtan, Xiangxiang, Chaling, Lingxian, Shuangfeng, Xinshao and Wangcheng should build silkworm mulberry production bases. Beishengqu Commune in Liuyang County and Jiangzhou, Songshi, Xinhe, Jinggang, and Panajia communes in Huarong County have relied on the masses to develop silkworm mulberry to bring about a brandnew situation of bumper grain harvests, flourishing mulberry, and high cocoon yields.

7. Tea: The province's tea production has developed fairly rapidly in recent years on an existing historical foundation. In 1976, tea was grown on 2.59 million mu, and both gross output and quantity purchased by the state was more than 800,000 dan, more than the all-time high record. The 1979 acreage was 2.51 million mu and gross output was 1,146,000 dan, with new development taking place. Bumper yield models such as the Mijiang Tea Farm, the Chunshan Tea Farm, Anhua Experimental Tea Farm, and the Provincial Tea Institute steadily came into view, and commune and brigade tea farms steadily developed. The province planned 25 tea base counties with an annual output of 50,000 dan, namely Anhua, Xinhua, Dongkou, Taojiang, Yiyang, Hanshou, Ningxiang, Lianyuan, Shuangfeng, Xiangxiang, Linxiang, Miluo, Pingjiang, and Xiangyin, as well as Yueyang, Changde, Changsha, Liuyang, Taoyuan, Linli, Chaling, Longhui, Shaodong, Shimen, and Lixian. The last listed 11 counties will require further efforts to meet high yield requirements. Principal future tasks will be keeping the growing area at its present size, striving to increase yields per unit of area, replacing varieties, improving processing technology for broken black tea, increasing output of green tea and jasmine tea, producing tea to meet needs in border areas, and devoting attention to tea quality.

8. Citrus fruit: Hunan Province has spacious semi-tropical zone red soil hills in which citrus resources and growing conditions are rather good. In 1966, citrus output was more than 970,000 dan, and Xuefeng honey oranges have found acclaim in international markets. The existing foundation should be used to take firm grip on revival of old producing areas in the valleys of the Yuan Shui and the Xiang Jiang, and develop new areas in southwestern Hunan as well as farther south in central Hunan. Simultaneous emphasis on oranges and tangerines has been a tradition in the province's production, and in view of cyclical low temperatures and freeze damage during the winter season, in addition to strengthening preventive measures, general methods should be adapted to specific circumstances in the siting of orange groves and in deciding the distribution of varieties, with appropriate concentration of growing in continuous tracts. In the main, groves should be in southern Hunan along Yangming Shan and south of Da Shan. In the basins and valleys of the upper reaches of the Zi Shui and Yuan Shui, ice rarely occurs and does not last long. Places that have had a minimum temperature no lower than -7°C over the years should be used mostly for the growing of sweet orange superior varieties in combination with the growing of Wenzhou honey oranges and superior varieties of pomelos. Other areas should be used mostly for the growing of Wenzhou honey oranges. Energies should be directed to the building of 15 orange and tangerine production bases in Qianyang, Shupu, Xinning, and Dongkou counties, Shaoyang City, Dongan, Daoxian, Qiyang, Hengshan, Yuanjiang, Liuyang, Lanshan, and Jiangyong County, and in Changsha and Zhuzhou cities. Liuyang and Lanshan counties should grow mostly kumquats, and Jiangyong should grow mostly superior variety pomelos.

II. Separate Tract Development of Forestry

The building of forestry should follow a program of "taking the running of forests as the foundation, with vigorous efforts devoted to afforestation and universal protection of forests so the green mountains will long remain and continue to be used forever." There should also be all-around planning and an equitable distribution of forests based on natural characteristics of all areas and socioeconomic conditions.

(I) The mountain plateau and hill region of western Hunan. In this region rainfall is plentiful, humidity high, the mountainland yellow soil well developed, and the structure of the soil comparatively friable, conditions making the area suitable for the growing of tung trees, Chinese tallow trees, Phoebe nanmu trees, eucommia, lacquer trees, Chinese toon trees, and diaolimu [066C 6849 2606], all of which like neutral to slightly alkaline soil. This region is suited to vigorous development of economic forests consisting mostly of tung oil trees, and continued attention should be given to the building of marketable tung oil bases. Bases should be built and continue to be developed on the existing foundation at Nuzhen (to grow wax insects), for Phoebe nanmu at Maoping, for lacquer trees at Daan, for Chinese tallow trees at Sangzhi, for walnuts at Fenghuang, and for eucommia bark, Chinese chestnuts, and cork chinaberry at Cili.

Hunan has a fairly large number of barren mountains suitable for growing a mixture of coniferous and deciduous trees, and for afforestation with

watershed forests and timber forests. Trees that should be planted include cypress (mostly in limestone mountain and hill regions), Chinese fir, pines, Chinese toons, Phoebe nanmu, Chinese sassafras, white oaks, sawtooth oak, and houzhang [3729 2874]. For mountainlands above 800 meters, armand pines, Chinese tulip trees, Betula Inminifera, Chinese aspens, and shiny leaf qinggang [0342 0673 7230 1481], all of which like cool temperatures may be used. Care should be improved to achieve self-sufficiency in timber with a surplus.

(II) Southwestern Hunan mountainlands and hill region. Here the climate is temperate and humid, with a relatively few number of hours of sunshine and many cloudy days. The mountainland yellow soil is well developed and suited to the growing of Chinese firs and Phoebe nanmu. Water transportation is also convenient, making this a major base in Hunan Province for the production of marketable timber. The Chinese fir forest base centered on Huitong should also be consolidated and developed.

This region has numerous barren mountains suitable for forests where a combination of sassafras trees, Phoebe nanmu and high mountain species may be grown. On the precipitous slopes along rivers, forests that are able to lock up water must be retained. Tung tree and tea oil trees are also widely distributed, and old forests of such trees should be revived and replaced. Bases should be built and intensive development given the mountain walnuts of Huitong and Jingxian counties, the lacquer trees of Chengbu County, the chestnuts of Yuanling, the pomelos of Anjiang, and the citrus fruit of Shupu.

(III) Southern Hunan mountainland and hill region. The main task here is afforestation and development of timber forests and economic forests. Since water and heat resources are fairly abundant, and vertical changes apparent, forest tree overwintering conditions are generally better than elsewhere. In the future it will still be necessary to place the growing of Chinese fir timber forests in primary position, link felling to growing, and consolidate and develop existing bases.

Active improvement of barren mountains linked to the selection of camphor, sassafras, bamboo, tung, tea oil, and cubeb litsea trees, and expansion of forest resources. In this region, tea oil trees are fairly well concentrated on continuous tracts making for prompt restoration and replacement of old mountain trees and appropriate expansion of the growing area. In the southwestern limestone region, consideration may be given to the development of marketable tung oil bases. Mang Shan is a base for special purpose forests in the province. It has numerous rare and valuable tree species such as Chinese hemlock, Guangdong pine, and huangchou [7806 4464], which should be earnestly protected, felled in a rational way, and scientifically dealt with. The region has numerous streams making convenient the floating out of timber. Both banks of streams and reservoirs are suited for the growing of trees to lock in water. Southern valleys receive much rainfall and ample heat. Valuable southeast Asian tropical plants may be introduced including various species of eucalyptus (white bark eucalyptus [4101 4122 0043], broadleaf eucalyptus [1684 0673 0043], valley eucalyptus [6253 0043], thin leaf eucalyptus [0673 0673 0043], and wild eucalyptus [6851 0043]), thick growing bamboo varieties, and other quick growing tree species.

(IV) Central Hunan hill region. Most of this region consists of hills and basins with the exception of Heng Shan as well as Longshan in the west, and the Mufu and Lianyuan mountainlands in the northeast at an elevation of more than 1,000 meters. Heat is abundant, and there is a marked distinction between dry and wet seasons. The soil is largely red soil. In some areas, forest trees are sparse and erosion serious. The area is suited to vigorous reafforestation with forests to conserve soil and water. It is also suited to the building of economic forest bases, notably tea oil trees, and for appropriate development of some timber production for self-sufficiency.

Transformation of the hills and mountainlands requires action at several levels including placing a hat (afforestation) of mountain tops, leaving a zone at mid-level (a belt for interplanting of farm crops and forests), and terrace farming at the foot of mountains or hills. Places not readily suited to reclamation and cultivation should be afforested and closed to human entry, closely linking the harnessing of mountains, waters, and soil. General methods should be adapted to local situations for afforestation with various kinds of oaks, paulownia, locusts, false indigo, Melia azederach, horse chestnut, tung, tea oil, etc. Most of these tree species are strong germinaters and provide the "five materials" (wood, fuel, fertilizer, fodder, and oil), and are also able to conserve soil and water. Masson pines tolerate drought and infertile soil and should be grown widely. Vigorous advocacy should be given afforestation of mixed forests. Other timber tree species that may be used are Chinese fir, oaks, camphor, sassafras, castanopsis, and gambiers. The scenic Nanyue and Yuelu mountains should be closed to human entry and attention given to preservation of valuable tree species there.

(V) The northeast Hunan low mountain and hill region. This includes the Mufu and Jiuling ranges, the Lianyun Shan and other fringe low mountains and high hills. We must properly range the existing secondary growth forests of Chinese fir, pine, bamboo, and oak on the basis of the principles of nurture, protection, care, and use, the canopy density being maintained at above 0.5. In Pingjiang and Liuyang counties, where there are large quantities of tea oil trees, revitalization should be done promptly and the base expanded appropriately. Various measures such as afforestation, human efforts to advance natural replacement, and closing off the mountains to nurture forests can be adopted to barren mountain areas to bring about their rapid greening. Some production of marketable timber may also be done over a period of time.

(VI) The northern Hunan low hills and plains region. The lake area is prone to threats from flooding and waterlogging, and winds there are fairly strong too. Vigorous efforts should be made to grow shelter forests. Trees that should be selected for planting are Chinese toon, Camptotheca acuminata, metasequoia, Chinese ash, willow varieties, paulownia, and locust, plus mulberry, varieties of bamboo, jipo willows [7741 1237 2692], Bischofia, Chinese tallow trees, and reeds. Building of windbreak forests is particularly important on the western and northern sides of the lake region. Wavebreak forests should be sited along the lowlying terrain to the southeast of the lake region. The principles of suiting general methods to specific situations and building defenses against threats should be followed to lay out various

kinds of forest belts. On the low hills around the lakes, tea oil trees, tung trees, and tea bushes as well as pines, oaks, locusts, camphor trees, and sassafras trees may be planted to attain a measure of self-sufficiency in timber over a period of time.

Only slightly more than 1 million mu remain of the province's primeval forests. They dot remote mountain regions like stars. Numerous valuable plants have declined dramatically, and some are even on the verge of extinction. Methods must be found to salvage them. A substantial amount of primeval forests and other valuable plant and animal life remains on Badagong Shan in Sangzhi County, at Zhangjiajie in Dayong County, on Shunhuang Shan in Xinning County, at Gaozeyuan in Jiangyong County, on Mang Shan in Yizhang County, and on Dawai Shan in Liuyang County. Natural preserve areas should be established at these places.

III. Animal Husbandry, Poultry Egg and Aquatic Products Bases

The hills, river valleys and plains, and the lake region offer many advantages for development of animal husbandry, poultry, and aquatic products. The cultivated land area is large; grain is plentiful; the people's grain consumption level is fairly high; there are numerous agricultural sideline products, stalks, stems, husks, and leaves of crops; fodder resources are plentiful; there are many hog strains, and people are accustomed to raising hogs. Mostly hogs and poultry should be raised, with development of grass-eating livestock at the same time. In places where there are many grassy mountains and grasslands, little cultivated land, and where pasturage conditions are good, a foundation exists for production of cattle, sheep, and goats. Mostly grass-eating animals should be grown in such areas, with concurrent attention given the growing of other livestock. Hill regions should develop both omnivorous animals and herbivorous animals at the same time. All jurisdictions should develop aquatic products on the basis of characteristics of waterlands, distribution of water surfaces, production capabilities, and aquatic products resources in their own areas.

(I) Marketable hog bases. Three large tracts may be delineated for appropriate concentration of marketable hog bases in continuous tracts as follows:

1. Northern Hunan tract: Yueyang, Linxiang, Huarong, Miluo, Xiangyin, Yiyang, Yuanjiang, Nanxian, Changde, Hanshou, Taoyuan, Linli, Lixian, Anxiang, Shimen, and Cili counties.

2. Central Hunan tract: Ningxiang, Hengyang, Hengshan, Hengdong, Hengnan, Changsha, Wangcheng, Xiangtan, Zhuzhou, Xiangxiang, Changning, Qidong, Qiyang, Shaodong, Xinshao, Xinhua, Lianyuan, Shuangfeng, Taoyuan, and Anbei counties.

3. Eastern Hunan tract: Pingjiang, Liuyang, Liling, Youxian, and Chaling counties.

The foregoing 41 counties had 62.65 percent of all hogs in inventory in the province as of the end of 1977, and a 62.6 percent overall removal from inventory rate. All but 12 of the counties sold to the state between 100,000

and more than 150,000 head of fattened hogs. They provided 62.4 percent of the province's total marketable hogs purchased by the state, a 54.8 percent marketable rate.

A superior variety breeding system has to be set up and perfected, with 15 places including Ningxiang, Changsha, Xiangtan, Taoyuan, Hengyang, Shupu, and Xinhuang becoming superior breed hog production bases and designated as protected development areas. Hybrid heteroses should be used to raise the removal from inventory rate and hog weight.

(II) Cattle, sheep, and goat bases. In Hunan Province, large livestock animals means cattle for the most part. Western and southern Hunan are cattle producing areas, and oxen are suited to high mountains with steep slopes, small hill plots, and places with numerous stones and drylands where the soil cover is rather thin. Central Hunan and parts of eastern Hunan are self-sufficient in a mixture of oxen and water buffaloes. In northern Hunan and along both banks of the middle and lower reaches of the four rivers, the terrain is low and flat, and the soil covering is fairly deep. Water plants grow in profusion, and numerous water buffalo are found there. These areas may be divided into three tracts on the basis of quantity and quality of oxen and water buffaloes in all areas, suitability for farming, degree of production of marketable animals, and future trends of development taken together with pasturage and fodder conditions for the raising of cattle.

1. Western Hunan marketable beef and lamb base: This includes almost all of the western Hunan autonomous zhou and Qianyang Prefecture, and parts of Shaoyang and Changde prefectures for a total of 28 counties (Jishou, Luxi, Huayuan, Baojing, Guzhang, Fenghuang, Yongshun, Dayong, Sangzhi, Longshan, Chengbu, Dongkou, Suining, Wugang, Xinning, Qianyang, Huitong, Tongdao, Shupu, Zhijiang, Huaihua, Xinhuang, Mayang, Yuanling, Chenxi, Jingxian, Cili, and Shimen). Here there is almost 10 million mu of pastureland and the frost-free period is long. These are also western Hunan's oxen and Luqi ma goat producing areas, which provide a definite foundation for cattle and goat production. In 1978, 37.5 percent of the province's total number of cattle in inventory were located here, and 63 percent of the total number of cows in the province were located here, most of them oxen. Sixty-four percent of the province's sheep and goats in inventory were here. The 10 counties in the western Hunan autonomous region are classed as national beef cattle bases, and Shimen and Lianyuan counties are classed as national goat skin bases.

2. The southern Hunan beef cattle base: This is located in Jianghua, Jiangyong, Lanshan, Ningyuan, and Shuangpai counties in Lingling Prefecture, and in Guidong, Guiyang, and Chenxian counties in Chenzhou Prefecture where there are more than 5 million mu of grassy mountains and grasslands for pasturage, and where beef cattle bases can be built.

3. The northern Hunan lake shore water buffalo base: This base consists of 17 units in 12 lake area counties plus Qianlianghu, Chunshan, Xidongting, Miluojiang, and Jianxin farms. There are about 1.5 million mu of grasslands on lake islands where cattle may be pastured. Water plants are abundant, and quality is rather good. Lake water buffalo are local superior breed draft

animals from south of the Chang Jiang with large bodies, great strength, and endurance. The main future course of their development should be purification and rejuvenation of the breed, and establishment of breeding areas. Second should be hybridization of superior varieties for development of animals that can both work and provide milk.

(III) Poultry and aquatic products bases

1. Poultry egg commodity bases: Sixteen lake region and nearby counties, and 18 central Hunan and nearby counties have traditionally raised poultry flocks, producing a large volume of chickens, ducks, and geese. In 1977, they provided the state with 81 percent of all marketable eggs provided by the province. Collective poultry raising endeavors should be actively developed on the existing foundation, with prefecture and county founding of superior breed breeding bases. The present seven superior breed poultry producing areas for production of Taoyuan chickens, lake area spotted ducks, Linwu ducks, Wugang geese, and Shupu geese should be designated protected areas, with establishment of superior breed farms. Further work should be done in purifying and rejuvenating breeds for steady increase in poultry egg production.

2. Aquatic products bases: Hunan Province has more than 20 million mu of water surfaces, more than 5.2 million mu of which may be used for breeding (1.5 million mu of inland lakes, 1.5 million mu of reservoirs, and 2.2 million mu of ponds). At the present time, one-fourth of water surfaces are not being used, and output of those that are being used is low. Use of water surfaces should emphasize the rearing of aquatic products, with special emphasis given intensive breeding. Places having requisite conditions should go in for a combination of rearing and breeding, protection and increase in aquatic product resources, improvement of the water surface utilization rate and of water body productivity.

Hill and mountain regions: Twenty-two counties are in the hill and mountain region, and they have 1.93 million mu of water surfaces, 1.63 million mu of which may be used for the rearing of aquatic products. They need to be provided with fry and given technical guidance. Eleven large reservoirs are included in the total (apart from the Kaibai fishery lake), providing 355,000 mu of water surfaces for the rearing of fish. Medium size reservoirs provide an almost 280,000 mu of water surfaces for the rearing of fish. Problems requiring solution are providing fish food, preventing the escape of fish, and eradication of pests and overfishing. One crop paddy areas of western Hunan capable of rearing fish should be revived and developed for the rearing of fish in paddyfields.

Suburban areas: There are about 50,000 mu of water surfaces in suburbs that provide a basis for intensive rearing of fish in ponds. Old fish ponds should be sensibly improved and adequate fish food provided for them. Changsha, Hengyang, Qidong, Qiyang, Shaoyang, and Shaodong all have rather abundant experience in the rearing of fish and are suitable places for establishing the rearing of fish in ponds for consistently high yields.

The Dongting Hu region: In this region, state-owned fish farms and commune and brigade fish farms should be used as a basis for building marketable fish bases and the specialization of production. In inner lakes, the lakes must be brought under control and fields elevated, and lake fields separated. Water surfaces suited to the growing of lotus should have bases established for the growing of Hunan lotus. Growing of reeds should be developed in shallows of outer lakes in the building of bases to provide raw materials for making paper.

Navigation on rivers and lakes, the basins of the four rivers, fish migration, spawning and reproduction, and overwintering grounds should be preserved to the maximum extent possible. Effective action should be taken to prevent industrial pollution and damage to the fishing industry through overfishing, and the ecological balance of bodies of water should be revived. Preserve areas in suitable bodies of water should be designated for rare and valuable aquatic product resources such as whitebait, river eels, baiqi [4101 7662], tortoises, and soft-shelled turtles, as well as black carp, grass carp, silver carp, and variegated carp.

(2) General methods should be adapted to specific circumstances to develop resources potential.

I. Readjustment and Reform of the Farming System

A rational farming system is one that makes full use of light and heat resources and institutes all-around measures of a strategic nature for combining use with nurture of the land and promotes ecological balance. This plays a very important part in overall agricultural production and brings about diversification, high yields, and increased earnings.

Since the founding of the nation, accompanying the launching of farmland capital construction in the province has been a gradual change in the farming of crops and crop patterns from single cropping to double cropping, from tall stem plants to short stem plants, from flooding of the fields in winter to growing winter crops, and from conventional varieties to the growing and promotion of hybrid varieties. These measures have resulted in considerable improvements manifested in increased yields. However, some places not fully in possession of proper conditions have lopsidedly emphasized increase in the multiple cropping index. But disparities in the amount of heat, moisture and soil fertility have made it impossible for farming techniques and plant protection to keep pace, and use and nurture of the soil have not been well linked. This has resulted in a rise in production costs, and aggravation of soil gleying and development of secondary gleying. Soil fertility has declined and outputs have wavered, fluctuated, or even dropped. Consequently, rational readjustment and reform of the farming system is needed.

(I) Elevation above sea level and heat conditions

Paddy rice likes warmth, wetness, and short days of sunlight. Its sensitivity to temperature reveals, in a qualitative sense, the close relationship between temperature and paddy development. In a quantitative sense, cumulative

temperature value demonstrates the specific heat requirements of different kinds of paddy. Normally, double crop paddy requires a temperature equal to or greater than 10°C and a cumulative temperature of about 4,700-5,300°C for safe growth, or alternatively a temperature that is equal to or greater than 15°C and cumulative temperatures of more than 4,100°C. Thus, local heat conditions are one important consideration in reform of the farming system. Amount of heat diminishes as altitude rises. On separately standing peaks in Hunan Province, for every 100 meter rise in elevation a drop of about 200°C occurs in dynamic cumulative temperatures for days when the average temperature has stabilized at 10°C or above 15°C. For a continuous mountain chain, the drop is about 120-150°C. For mountain basins or for hill and table lands at 500-600 meters above sea level, cumulative temperatures when the daily average temperature is above 10°C are between 4,700 and 4,900°C. For above 15°C days, cumulative temperatures are 4,200-4,300°C. Cumulative temperatures drop greatly at 800-900 meters above sea level. Cumulative temperatures for days above 15°C drop below 4,000°C (Table 34). However, the cumulative temperature value for paddy rice varieties increases as elevation increases. The growing season lengthens, and actual cumulative temperatures needed increase greatly. In addition, the increased height of the terrain, the greater number of clouds, the fewer sunny days, the cold water in high mountains, and infertility of the soil mean more unfavorable influences for the growing of paddy rice.

Table 34. Comparison of Temperatures (°C) Limits at Different Elevations Above Sea Level

(a) 地点	(j) 海拔高度 (米)	(k) 日平均气温10℃以上的			(o) 日平均气温15℃以上的		
		初(l)日	终(m)日	积(n)温	初(l)日	终(m)日	积(n)温
(b) 衡阳	103	28/3	22/11	5510	17/4	30/10	4885
(c) 南岳	1266	20/4	14/10	3615	20/5	22/9	2477
(d) 郴州	185	24/3	18/11	5546	13/4	26/10	4752
(e) 汝城	608	25/3	17/11	4926	14/4	21/10	4312
(f) 桂东	866	27/3	11/11	4618	18/4	16/10	3961
(g) 龙山	486	23/3	15/11	4927	16/4	25/10	4211
(h) 雪峰山	1401	25/4	16/10	2998	23/5	20/9	2236
(i) 东山峰	1489	3/5	9/10	2536	8/6	11/9	1782

Key:

a. Place
b. Hengyang
c. Nanyue
d. Chenzhou
e. Rucheng
f. Guidong
g. Longshan
h. Xuefengshan
i. Dongshanfeng
j. Elevation above sea level (meters)
k. Average daily temperature of above 10°C
l. First day
m. Final day
n. Cumulative temperature
o. Average daily temperature of above 15°C

Preliminary calculations show 3.42 million mu of paddyfields in the province as being above 500 meters above sea level (Table 35). Though this is only 8.4 percent of the province's total paddyfield area, it is an important matter that cannot be ignored in reforming the mountain region farming system.

Table 35. Statistics on Wetlands at More Than 500 Meters Above Sea Level in the Province

(a) 地区	(g) 面积 (亩)	(h) 比重 (%)
(b) 合计	3420571	100
(c) 湘西	2488501	72.7
(d) 湘南	791693	23.2
(e) 湘中	110880	3.2
(f) 湘北	31497	0.9

Key:
- a. Place
- b. Total
- c. Western Hunan
- d. Southern Hunan
- e. Central Hunan
- f. Northern Hunan
- g. Area (mu)
- h. Percentage

In recent years, some places in the province's mountain regions have reformed their farming systems on the basis of differing topography, thereby gaining heartening results. In western Hunan, except for mountain basins such as Shupu and Qianyang at an elevation above sea level of about 200 meters, most other places are at an elevation of 400-1,000 meters. There are range upon range of mountains; the mountains are high and the valleys deep; and the difference in elevation of fields is great. Ever since 1974, Shimen County has grown two crops of paddy in places at a low elevation above sea level where sunlight, heat, and water conditions have been favorable. At places fairly high above sea level, the county has changed to the growing of a single crop of intermediate paddy and has developed the growing of dryland crops for a tremendous increase in the county's grain production. In southern Hunan too, the topography undulates greatly. In southeastern Hunan, in particular, 40 percent of the total area of Linxian County is higher than 700 meters above sea level. In Ruchen County, it is 55 percent; and in Guidong County, 90 percent. Guidong County used to grow two crops of paddy, but large area yields were very low. In 1977, it grew 77,000 mu of intermediate hybrid rice for yields averaging 815 jin per mu. The foregoing illustrations lead to the overall conclusion that the elevation for growing two crops of paddy in Hunan is below 400 meters in western Hunan, and below 600-500 meters in southern Hunan. When paddy is grown at these elevations in conjunction with a proper farming system, increased yields can result.

(II) Selection and use of kinds of soil

In addition to considering elevation above sea level, and vertical differences in atmospheric temperature in reforming the farming system and crop

patterns, it is also necessary to plan production by suiting general methods to specific circumstances in accordance with different kinds of cultivated land.

Flat fields in basins: This includes fields with embankments reclaimed from bodies of water in the lake region and the lower reaches of the four rivers, river valleys in hill areas, fields with upraised paths through them and large flat fields [0641 3944], as well as sinkhole fields in mountain basins. Except for those that are lowlying and accumulate water and those with fairly thick mud, most are suitable for a two or three crop farming system, and efforts should continue to be made to stabilize such farming systems. In hill river valleys and plains and in lake regions, mostly a system of rice-rice-green manure is used, and systems are being actively promoted for rice-rice-oil-bearing crop (rape), or rice-rice-beans. In experimental fields in Nanxian, where a rice-rice-oil-bearing crop (rape) has been tried, rape yields have been more than 400 jin per mu. Not only has this increased both output and earnings, but it has also made available plenty of cake fertilizer for the next two crops of rice. From experimental fields growing rice-rice-broad beans, broad bean yields have been more than 400 jin per mu. Increases in spring grain yields have also nurtured soil fertility. Hengyang used to be a famed grain and bean growing area, and in 1977, the Linghu Agricultural Science Station in Hengyang tried out a farming system of beans-late crop hybrid rice-green manure, which produced soybean yields of 203.5 jin per mu, and paddy yields of 1,119.4 jin per mu.

Valley alluvial fields: In the main drift [0031 0394] section of downlands, the land utilization rate is fairly high. Results in increasing yields are about the same as for paddyfields in plains areas. In branch drift [2388 0394] and fork drift [1479 0394], and in poorly drained alluvial fields [0394 1442 3944], however, rotational cropping of one wetland crop and one dryland crop is best. In shaded mountain cold waterlogged fields, ditches must be dug to drain waterlogging for the planting of one crop of potatoes and one crop of intermediate hybrid rice. In another kind of cold waterlogged muddy field that has not been improved, it is best to transplant a single crop of intermediate rice. After planting a single crop of rice in improved fields that had formerly been flooded in winter, every effort should be made to plant another dryland crop or some other crop.

Slope terrace fields: Soil quality and nitrate ground water conditions are fairly ideal for erpaitian [0059 2226 3944] in hill regions, and productivity is good being about the same as for ridged fields and large flat fields. If the water is available, one crop of late maturing early rice and one crop of autumn potatoes may be grown. Where a source of water is not dependable, a crop of intermediate maturing early rice and a crop of autumn potatoes may be planted. In fields that depend solely on rainfall, the fields may be plowed during the time of spring rains, and early maturing early rice may be transplanted as the first crop. Autumn potatoes may be planted as a second crop. If water sources are insufficient for a crop of paddy, dryland grain may be grown.

Dryland fields: Formerly two crops a year were grown on dryland fields, but a multiple cropping system has gradually been adopted of spring corn intercropped with soybeans-wheat (or broad beans or rape), or of sweet potatoes intercropped with soybeans-wheat (or broad beans), or spring corn intercropped with sweet potatoes-green manure.

(III) Attention to crop rotation using the short-term to provide for the long-term.

Except for a portion of paddyfields concentrated in the lake region, most of the province's paddyfields are found in hill basin areas. The complex topographical structure of hills and alluvial flats crisscrossed by numerous ravines has produced many types of paddyfields laid out in the shape of tree branches or concentric rings, and discontinuous land and continuous land frequently alternate. Within the same area there may be a very great variation in sunlight, heat, water, soil, and weather conditions for different kinds of paddyfields. Obviously a corresponding farming system must be adopted for these different kinds of paddyfields if the land is to yield its maximum benefits. For example, the deep mud cold waterlogged fields, and the fields at high elevations that depend solely on rainfall require not only action to bring the water under greater control and to improve the soil, but also require the adaptation of general methods to specific situations for a combination of methods for growing crops such as single crop paddy-rape (or green manure, wheat, or broad beans), spring soybeans (or spring corn)-late paddy. Most of the province's paddyfields grow two crops of paddy plus a catch crop in a three crop per year system. Though this method plays a major role in increasing the soil utilization rate and in increasing gross output of grain, it also produces a "much work technical system" that is bad for development of economic diversification. Flooding of the soil for long periods of time is bad for the nurture of soil fertility, and growing two paddy crops in a row does not make fullest use of light energy potential during July and August.

For these reasons, a proper proportion of wetland and dryland crops for paddyfields in a multiple cropping system must be worked out. Even in places where a double and triple crop system predominates, attention must be given to the ratio among grain, oil-bearing crops, and green manure. The mix of various crops must be rotated in a cycle, and the percentage of pulse crops grown in various crop rotation systems for paddyfields should be increased. In central and southern Hunan, the growing of spring soybeans followed by hybrid rice, or of early maturing intermediate rice followed by autumn soybeans should be promoted. Areas that grow two crops of paddy should also plant broad beans, rape and green manure. Coordination of farming skills and farm machinery should also be considered at the same time. This will help nurture soil fertility and sustain increased yields, will help improve the structure of agriculture and the structure of the diet, and will help increase both machine farming and labor productivity rates.

II. Improvement and Use of Red Soil Wastelands

As a result of high temperatures and much rainfall over a long period of time as well as marked alteration between dry and wet seasons, the various kinds of

rock found on the surface of the earth in Hunan Province have been strongly weathered and leached. The primitive minerals and organic matter have been thoroughly broken down and rapidly leached. The sediment argillic process and the process of silicon removal and aluminum enrichment (also termed the process of making red soil) has produced a thick, red weathered residuum, and this plus semi-tropical zone forest cover biological factors has produced classic red soil as well as transitional types of yellowish red soil and purplish red soil. The degree of base saturation of red soil is generally slow, and it produces an acidic reaction. It contains little humus and is clayey. The solum is readily broken up, and the soil has the common failings of acidity, clayeyness, and infertility. However, because of differences in the kinds of mother material from which it was formed, the slope of the terrain and the kinds of vegetation cover, thickness and fertility of the soil layer differs very greatly.

With exception of the lake plain and parts of western and southern Hunan Province, red soil is found widely in the hills, downlands, and in some low mountain regions of the province over an area of more than 100 million mu. As a result of reckless cutting and denudation over a fairly long period of time, the forest cover has been destroyed, and red soil wasteland now covers about 60 percent of the province's barren mountains and slash lands. Soil erosion is common everywhere, and in places where it is serious, a shortage of the "five materials" frequently occurs, posing a direct threat to farmlands.

Red soil wastelands are both a "burden" and a major soil resource. They have both shortcomings and also provide a thick layer of soil from which plant nutrients are quickly released. They are able to promote development of soil fertility and have inherent production potential. Particularly inasmuch as such soil is found in major agricultural areas and adjacent to inhabited areas, the need is all the more urgent for its rapid improvement for use. With the integration of farming, forestry, and animal husbandry and the building of ecological balance as a premise, the following actions should be taken by suiting general methods to specific circumstances on the basis of the characteristics of different kinds of red soils:

1. Multiple uses of single hills, with intercropping of grain in forests. The tops of red soil hills usually have a fairly steep slope and the soil layer is fairly thin, suiting them to afforestation with water and soil conservation forests, firewood forests, or timber forests, and the growing of perennial shrubs. This would not only make the barren hills green and conserve soil and water, but would also provide a source of fertilizer. On slopes with a gradient of less than 25 degrees, economic forests of tea and tea oil plants could be planted. Citrus could be grown on south slopes, and timber trees could be selected for north slopes, preferably for mixed forests. Gentle slopes of less than 15 degrees could be planted to dryland crops, green manure, and livestock fodder. Crops and trees to be planted in red soil should be able to tolerate drought, lack of soil fertility, and acidity. For red soil that has developed from granitic mother material, in particular, quick growing trees that tolerate lack of fertility or vanguard crops should be selected. As the degree of maturity of red soil increases,

some cash crops requiring greater fertility may gradually be grown. Other low hill areas should also preserve a certain forest tree area.

2. Rotational cropping to nurture fertility and improve the soil. When red soil is first cultivated, the multiple cropping index cannot be too high. Usually two crops a year may be grown. A rotational cropping system should be selected that consists of sweet potatoes-broad beans (or peas); millet or gaoliang-broad beans (or peas); and peanuts or sesame-broad beans (or peas). Once soil fertility has increased after several years of cultivation, rotational cropping may consist of wheat-soybeans; and sesame or sweet potatoes intercropped with soybeans-wheat (or broad beans). In view of red soil's lack of organic matter, special consideration must be given to the growing of green manure or pulse crops as part of crop rotation. Crops may also be interplanted in orchards to improve soil structure and increase fertility. In addition, judicious applications of phosphate fertilizer and lime should be made to increase the soil's effective phosphate and hasten its maturation.

3. Building of ridges across slopes to conserve the soil and withstand drought. Temperatures run fairly high in the province's red soil areas, and a lot of precipitation falls. Crops may be grown all year round. However, since rainfall distribution varies from one season to another--many torrential rains falling in spring and summer and drought occurring during the height of autumn--and since the structure of red soil is poor and porosity bad, this plus the slope of hills makes the land prone to scouring during the early part of the year. During the latter part of the year when rainfall is lacking, the soil, which is limited in its ability to regulate dryness, becomes open to drought disasters. For these reasons, in addition to afforestation with soil conservation forests as part of dryland capital construction, it is also necessary to build slope terraces and ridges, to dig a combination of ravines to intercept water and to impound water; and to do contour farming across transverse slopes. On slopes where the lay of the land is complex, the method of planting on double terraces in a fish scale pattern should be used. The topography or the location of water sources should be used to dig ponds to impound water, or else divert or raise water for irrigation, with active development of spray and drip irrigation.

III. Obtaining Materials Locally To Develop Commune and Brigade Enterprises

Hunan Province has abundant natural resources. The mountains and hills that cover more than 70 percent of the area of the province contain vast land and large amounts of forest resources that may be used in multiple ways. Thirty percent of the more than 20 million mu of water surfaces may be used for rearing, catching, and breeding aquatic products. Hydroelectric power stations may be built on the more than 5,000 tributaries of the four river systems, and the electric power produced may be fully used for irrigation and for industrial and sideline production. There are many minerals underground that can be mined and used. Light industrial raw materials are also abundant and of many kinds. Commune and brigade enterprises can do rough processing of numerous raw and processed materials. In recent years, simultaneous with their rearrangement of mountains and rivers, and the tackling of fields, the soil, mountains, water, and roads in a comprehensive way, all

jurisdictions have also started up various kinds of enterprises, and a large number of advanced models have appeared.

Lake region counties: Places such as Huarong, Nanxian, and Yuanjiang counties have coupled major efforts in garden style farming with harnessing water surfaces and lake islets for use. They have suited general methods to specific circumstances to operate commune and brigade lotus farms, reed farms, mulberry groves, fish farms, hog farms, and duck farms.

Hill region counties: Hill region counties such as Taoyuan, Taojiang, Hengdong, and Zhuzhou have linked control of mountains and water to the building of large area commune and brigade forest farms, tea oil farms, bamboo forest farms, tea farms, horticultural farms and medicinal herb farms, and hog farms.

Mountain region counties: Mountain region counties such as Huitong and Shuangpai have made major efforts in the planting of trees for afforestation and replacement of trees on cut over land. They have established fairly large scale commune and brigade gathering and producing points and livestock farms, and they have linked the development of streams and diversion of water for irrigation in major efforts to operate small hydroelectric power stations.

Counties and cities with substantial mineral deposits: Counties such as Linwu, Sangzhi, and Lengshuijiang have done all-around planning and have made rational use of resources without competing with the state for resources to develop a large number of commune and brigade coal mines, lead and zinc mines, wolfram mines, magnesium mines, iron mines, and various kinds of non-mineral mines.

Xiangtan, Changsha, Hengyang, Zhuzhou, and Shaoyang suburban areas have linked industrial plants and communes. They have processed state-owned enterprise products and spare parts and used the "three wastes" [waste gas, waste water, and industrial residues] for developing commune and brigade machine, chemical industry, light industry, sideline food processing, and hauling enterprises.

While devoting serious attention to mainstay enterprises, all jurisdictions have also devoted major attention to enterprises for the processing of agricultural sideline products such as the milling of rice, ginning of cotton, squeezing of oil, preparation of tea, manufacture of paper, and manufacture of bamboo and wooden wares. They have also operated enterprises for making and repairing farm implements, capital construction enterprises, and enterprises to make pesticides and cement.

Local acquisition of materials to develop production of traditional light and handicraft industries. Examples include porcelain from Liling, firecrackers from Liuyang, Hunan embroidery from Changsha, cool bamboo mats from Qiyang, bamboo and wooden carvings from Shaoyang, and small hardware items from Shaodong.

The province's commune and brigade enterprises will continue steady development in future through readjustment and reorganization. They will follow the principles of central state planning and adaptation of general methods to specific situations, stress use of local resources, acquire materials locally, and develop the farming industry, breeding industries, processing industries, and mining industries.

(3) Comprehensive Control, and Intensification of Agricultural Capital Construction

Intensification of agricultural capital construction entails integrated control of mountains, control of water, and improvement of soil, and tackling problems of villages, mountains, water, fields, forests, roads, and gas (methane gas) in a comprehensive way. This is the only way in which to create and maintain a fine ecological environment. A realistic way to do this is to devote vigorous efforts to afforestation, to the greening of bald mountains, and to continue to do a good job of building water conservancy and providing fertilizer, with gradual mechanization of agriculture.

I. Firm Attention to Construction, Continued Construction, Equipping, and Tapping Potential of Water Conservancy

Hunan Province has scored very great achievements in farmland capital construction, which have advanced development of agricultural production. It should also be realized, however, that about 40 percent of wetlands are as yet unable to guarantee a harvest despite drought or floods, and yields from 32 percent of those wetlands that can deliver such a harvest are not yet consistently high. An additional approximately 24 million mu eroded area in the province has not yet been controlled very well. Water and drought disasters plus soil erosion hurt sustained increases in agricultural yields to a significant degree. The main problems in water conservancy are as follows:

A great imbalance exists in water conservancy construction from one area to another. For the province as a whole, fields that can deliver a harvest despite drought or flood average out at 0.7 mu per capita of agricultural population. Put in regional terms, the average is about 1 mu for northern Hunan, 0.69 mu for southern Hunan, 0.69 mu for central Hunan, and no more than 0.54 mu for western Hunan. The total volume of water stored in all existing projects in the province averages out to about 577 cubic meters per mu. Some places have but few main water conservancy projects. Each of the 31 counties in western Hunan have an average of only 1.5 medium size reservoirs, and some counties have no main water conservancy projects at all. Most of the province's 11 million mu of drylands are slopes on which the "three runoffs" (runoff of water, soil, and fertility) are conspicuous. Another considerable portion consists of cold waterlogged fields and flooded fields urgently in need of improvement.

The large, medium and small water conservancy projects that have been built or are abuilding offer great potential, and the task of fully equipping them is a great one. There are 1,644 small type (1) or above irrigation sites in

the province designed to irrigate 24,189,000 mu of fields. Statistics show 15,329,000 mu of fields as being actually irrigated from these sites as of 1974. As of the end of 1977, the actual area irrigated by small type (2) irrigation sites was only about 60 percent of the designed area. It has been estimated that more construction, equipping and expansion, and eradication of duplicatory irrigation areas can increase the irrigated area from which a harvest can be guaranteed to more than 5 million mu (including a 4 million mu increase in the irrigated area from proper equipping of large and medium size reservoirs). There are about 400-odd medium and small reservoirs that have been newly built but on which work has not yet been completed, and more than 1,900 medium and small reservoirs that are not yet fully equipped. More than 1,000 flood prevention facilities have not yet been fully completed. Therefore, it is necessary to take a firm grip on the equipping of projects, insure project quality, and make full use of benefits that completed projects can provide.

Silting is serious in the Dongting Hu region. Year by year the lake bed rises, and flood prevention dikes capable of withstanding a flood such as occurs only once every 20 years exist along only about 50 percent of the total length of the dikes. The area of internal lakes is steadily shrinking, lowering capabilities to impound floodwaters. As a result demands on drainage and irrigation have become higher, but designed electrical drainage capacity is overly low and cannot satisfy needs for draining away waterlogging.

Quite a few problems also exist in management of water conservancy projects. Managerial organizations in some places are not in good shape; standards for projects are low and project quality is poor. During high water season virtually every year reservoir dams burst.

Further good work in farmland capital construction will have to be done in the future, and a water conservancy program of "taking small scale projects, full equipping, and operation by communes and brigades themselves as key links" will have to continue to be carried out conscientiously. All-around planning, suiting of general methods to specific situations, and multiple uses will be required for entire basin areas beginning with individual regions. Impounding of water must be the main direction of efforts in a combination of impounding, diverting, and raising of water. There must be genuine strengthening of project management. Simultaneous with the harnessing of waters must be a harnessing of mountains and soil improvement so that the harnessing of mountains and waters, soil improvement, and the making of fields are closely linked. Projects that cut across commune and brigade foundations should be under unified direction and be carried out according to the principles of "all-around planning, phased construction, sequencing of benefits, and mutual assistance for mutual benefit" with the organization of socialist cooperation. Efforts should be made to improve low yield field soils to strengthen water and soil conservation, to expand the irrigated area, and to achieve guaranteed harvests of consistently high yields despite drought or flood. Where projects are to be built should depend on drainage basin and regional circumstances.

(I) Dongting Hu region: Most important in this region is flood prevention and drainage of stagnant water, and acceleration of the building of garden style farming to assure increased yields and bumper harvests of grain and cotton. Flood disasters are still the most important present threat in this region. Until such time as root causes of flooding in the middle and upper reaches of the Chang Jiang and of the four rivers have been brought under control, the emphasis will have to be on the dredging of flood channels, flood prevention, draining of waterlogging, navigation, and guarding against flooding around the lakes.

Flood prevention: Dikes will have to be made higher and strengthened, and major in-between dikes built, a good job done of protecting their slopes and their bases, and planting of shelter forests. They should be built to withstand a flood such as occurs only once every 20 years, i.e., to withstand the flood level that occurred during 1954 and 6-force winds without collapsing. About half the dikes should be built to withstand a flood such as occurs only once every 100 years. At the three points where the four rivers branch out to enter the lake, some branches should be blocked and the flow channeled for control of the water system and to reduce the danger of silting. At the same time, a good job should continue to be done in building projects to impound floodwaters safely and to guard against flooding around the lake, and in building protective slopes along the banks of the Chang Jiang.

Draining of stagnant water: There must be all-around renovation of the drainage and irrigation systems inside embankments, advantage taken of existing projects, and sluice gates or cement conduits installed in a major effort toward gravity flow irrigation. Electrically powered drainage and irrigation should be increased for a phased movement of water, a high volume being drained away when the water is high and a low volume being drained away when the water is low. Flood waters should also be impounded area by area, so that when 3 days of torrential rains such as occur only once every 10 years occurs, the stagnation of water will not cause a disaster.

In developing garden style farming, simultaneous with improving flood prevention, drainage, and irrigation firm attention should be given to fully equipping the ditch system, digging out the lake, and making upraised fields, vigorous efforts given to building garden style farming, and full use of the "four besides" and outer flats to plant trees and do afforestation a la Anxiang County where "the fields form squares, ditches form a network, and trees form rows." The emphasis should be on building existing cultivated land into fields that produce consistently high yields.

Active dredging of flood channels, controlling water and attacking the silting problem so as not only to reduce flood disasters but also to help navigation. Where dikes obstruct movement at strategic points, boat locks or boat lifting equipment should be installed for active solution to the problem of communication between inner and outer lakes.

(II) Mountain and hill regions: The main task in these regions is to expand sources of water for irrigation, to improve capabilities to withstand drought, to strengthen and upgrade water conservancy facilities already existing in

central Hunan and in hill regions around the lake, further develop water conservancy (and power) resources in southern Hunan, and transform the water conservancy situation in western Hunan as quickly as possible.

Increase in small-scale water conservancy: All mountain and hill regions should build more small water conservancy projects, take a firm grip on continuing to build and equip them, strengthen and upgrade effectiveness of existing water conservancy facilities, insure project safety, strengthen management, and eradicate the channeling of irrigation and drainage along furrows. They should build some large and medium size principal projects in a planned way, expand water sources, plant chang teng jie gua [7022 5671 4814 3900] and create very dissimilar but complete water conservancy systems. The hill areas of Hengshao and Huaihu are important as storage and pumping water conservancy areas; Hunan and Hudong as storage and diversion water conservancy areas. At the lower reaches of the Yuan Shui and Li Shui where the mountains are steep and valleys deep, the fields are high and water level low, and cultivated land is scattered, it is important to create small-scale scattered water conservancy facilities, take water storage as the key, and take the lifting and diversion of water to supplement irrigation. In the small number of places where cultivated land is not dispersed, mainline projects should be built. Wherever sources of water are dependable, general methods should be suited to specific circumstances for development of small hydropower stations, waterwheel pumps, and electromechanical methods for lifting water for irrigation in order to solve the need for water on farmlands on both banks of rivers and the problem of electricity supply for small county, commune, and brigade enterprises as well as for processing of agricultural sideline products.

Building of basic farmlands: Xiangtan County took into account the features of its hill and downlands areas. Building of garden style farming there required, first of all, getting the water system into condition, laying out ditches, and making drainage and irrigation easy. Next came leveling of the soil and the building of fields of standard dimensions. The third step was good performance in building villages and hamlets. Mountain regions took the course of making high land uniformly high and making low fields uniformly low, of cutting curves so they became straight, and putting fields in shape step by step. Standardization without arbitrary uniformity was encouraged together with adaptation of general methods to specific circumstances and the seeking after genuine results.

II. Widening Sources of Fertilizer To Insure Crop Nutrition

"Fertilizer is food for plants." With increase in paddy yields per unit of area and a rise in the multiple cropping index, as well as expanded growing of all kinds of crops, requirements for fertilizer have also become increasingly great. Measurements show paddy yields of 1,000 jin per mu require absorption from the soil of between 20 and 25 jin of nitrogen, between 9 and 13 jin of phosphate, and between 21 and 33 jin of potash. Because of loss through erosion and deoxidation, about 51 percent of the nitrate used on paddyfields, 30 percent of the phosphate, and 64 percent of the potash were used. Thus, between 30 and 50 percent more fertilizer is used on paddyfields

than is actually absorbed. The current insufficiency of fertilizer is largely an insufficiency of base fertilizer. Fertilizer is also insufficient for some fields on which early paddy is grown, and the shortage of fertilizer is even more acute for late paddy. Therefore, in addition to depending on fertilizer plants for large quantity production of chemical fertilizer, sources of manure must be expanded and fertilizer equitably used to assure normal crop nutrition.

1. Active increase in green manure yields per unit of area. Green manure is grown everywhere throughout the province during winter. The growing area is large but output is not high, and a lack of diversification exists in the kinds of green manure that are grown. Yields of 2,000 to 3,000 jin per mu have to be increased two or three fold, so that a single mu of green manure is able to take care of 2 or 3 mu of fields. In growing green manure, mixed sowing of Chinese milk vetch seed with rapeseed, or manyuanhua [3341 0954 5363] with oats or barley performs better in increasing output, providing balanced nutrition, and improving the soil. In some places in Hunan Province, intercropping of green manure with spring harvested crops (such as wheat or rape) has produced fresh grass yields of as much as 1,000 jin per mu. In addition, summer green manure and large-scale planting of pulse crops may be done. Intercropping of sesbania in early paddyfields increases the supply of manure for the late paddy crop.

2. Use of water surfaces to grow water cabbage, water hyacinths, water peanuts [althermanthera philoxeroides], and azolla. The province's mountain and hill regions contain numerous ponds and creeks, and its lake regions are crisscrossed with streams. All that is needed is solution to the conflict between using them for the rearing of fish and the growing of aquatic green manure. Large quantities of water peanuts, water cabbage, and water hyacinths may be grown in them. If properly tended, a single mu of water surface can produce several tens of thousands of jin, which may be used either directly as fertilizer, or first fed to livestock for conversion into manure. Intercropping paddyfields with red azolla and raising of azolla in late paddy seedling fields can produce as much as between several thousand and several tens of thousands of jin of green manure for use as fertilizer.

3. Large-scale raising of hogs to accumulate fertilizer. "A single hog is a small fertilizer plant," capable of producing more than 40 dan of manure annually. This is equivalent to 100 jin of ammonium sulfate, or 40 jin of calcium superphosphate. The more hogs, the more manure; and the more manure, the more grain. It is a universal law. Central Hunan and other high yield grain producing areas in the province should also help apply this law to effect to a very high degree. Whether feeding hogs or raising cattle, one should build sheds and give attention to the bedding of stalls so as to actively conserve manure. Collection of manure in conjunction with composting to produce methane gas is a multiple way of using manure both to conserve nutrients and to solve, in part, the conflict between collecting manure raw materials and fuel.

4. Encouragement of accumulation of manure in three composting pits and in compost heaps. Some prefectures in northern and central Hunan have the

custom of composting manure in pits. Every production team has a large composting pit used year round; every hill has a field composting pit, and every household has a hot water composting pit, which may be made anywhere. Places having requisite conditions should encourage use of plant stalks and stems for high temperature composting in heaps, with regulation of the percentage of carbon and nitrogen to promoting rotting and derive benefits in manure during the same season.

5. Exploration of humic acid fertilizer. This is a new kind of organic-inorganic fertilizer. It is effective as a fertilizer in many ways. Mostly it is able to change soil structure and increase the soil's ability to retain fertility. Under certain conditions it is able to stimulate crop growth. A considerable number of places in Ningxiang, Liuyang, and Xiangxiang counties in the province produce large quantities of peat, lignite, and weathered coal that provide abundant sources for the making of humic acid fertilizer. This is worth active exploration and increased use. Not only can this expand the sources of fertilizer, but can also hasten the process of nurturing soil fertility and accumulation of humus.

6. Energetic increase in output of chemical fertilizer. Hunan has fairly plentiful mineral resources useful in agriculture as follows: (1) Coal mines: Reserves of more than 2.8 billion tons have already been verified, of which only 1.57 billion tons have been excavated for use. These coal reserves are found in more than 70 counties and municipalities, and are largely concentrated in the Lianyun-Shaoyang coalfields and the Tanning coalfields in central Hunan, and in the Chenlai coalfields of southern Hunan. In addition to providing coal for power and use in daily life, large quantities can be provided to make nitrates. (2) Hunan Province is one of the five major phosphate rock producing areas in the country. Phosphate rock deposits are found in northwestern and east central Hunan. Verified reserves total about 800 million tons, and long range reserves amount to about 1.2 billion tons. They are concentrated at Qingguandu and Dongshanfeng in Shimen, and at Yonghe in Liuyang, and are important raw materials for the production of calcium superphosphate, and calcium magnesium phosphate. (3) Potash fertilizer raw materials. Current sources of supply are kiln ash potash, potash calcium fertilizer, phosphate potash fertilizer, and silicon magnesium potash. Production of these requires potassium feldspar, limestone, dolomite, coal, and gypsum, all of which are produced in the province. In addition, the pyrite ore produced at Jinshiling and elsewhere in Chenxian County, and the red orpiment produced at Jiepaigu in Shimen are important raw materials for the manufacture of chemical fertilizer and agricultural pesticides respectively. They should be used well for steady expansion of the supply of fertilizer.

III. Gradual Agricultural Mechanization

Ever since the founding of the nation, Hunan Province has stressed use of electric power for drainage and the building of small nitrate fertilizer plants as part of the mechanization of agriculture. It has hastened the pace of agricultural mechanization. Major existing problems are slow development of tillage machinery and power machinery. The extent of the

"three -izations" [standardization, serialization, and interchangeability] is low, and numerous problems continue in farm machinery management, maintenance, and repair.

Kinds of implements are few and degree of mechanization is low. Currently 23 percent of the total cultivated area is machine plowed and harrowed. This includes a machine-plowed area of only 2.7 percent, and the extent of mechanization of machine sowing, machine transplanting, fertilizing and harvesting is less than 1 percent. Machines for transplanting seedlings and cultivating paddyfields, and for forestry and the fishing industry are virtually nonexistent.

Specialization of production is poor, and the extent of the "three -izations" is slight. Hunan Province produces only about 10,000 water pumps annually. Furthermore, it has no main plant for pump production, few plants specializing in their production, and sites where they are made frequently change. Poor interchangeability and nonstandardization of parts causes very great difficulties for maintenance and repairs.

Quite a few problems exist in the management of machines, and a situation generally exists of "three lows" (low in-service rate, utilization rate, and work attendance rate), "one high" (high costs), and "one many" (many accidents), which means full use cannot be made of farm machines. Many tractors have been out of repair for years.

Insufficient coordination among farm machine, farm technician, agronomy, and user units. For example, transplanting machines should be made to accommodate a wider variety of seedlings, and the growing of seedlings must also be suited to machine transplanting. Research on paddy cultivators, and cultivating machines must be suited to farming requirements, and a suitable width between rows and closeness of plants must be explored in paddy rice production techniques, both to help increases in yields, and to help development of paddy cultivating machines for use. Such coordinated research and experimentation remains a weak link. Some farm machinery and implements for which the design has been set or preliminarily set have not been well promoted and have taken hold only slowly. The province's mountain regions urgently need high lift water pumps capable of raising water above 100 meters for which research and development are awaited. In recent years, nearly 40 percent of the lake region has had stagnant water, and building of large pumping stations is anxiously awaited.

Inasmuch as every member of the agricultural workforce in Hunan Province is responsible for an average of about 2.6 mu of cultivated land, and since the paddyfield area and the double rice crop area each account for about 80 percent of all cultivated land and paddyfields, with development of the national economy, the multiple cropping index, the intensivity of farming, and steady increases in yields per unit of area must increase. In addition, all-around development of farming, forestry, animal husbandry, sideline occupations, and the fishing industry is necessary. In this process, inevitably new conflicts will arise between workforces and the land, among individual agricultural sectors, and between crop strains and soil, fertilizer, water, and

seeds. Further regulation of the proportional relationship among all sectors of agriculture and of the internal structure of agriculture, and an equitable distribution of manpower, material, and financial resources will be necessary to maintain all-around coordinated development of sustained increases. In view of existing production conditions in the province, agriculture still depends largely on hand operations, and it is unable to meet new needs in the development of production. In order to improve labor productivity rates, reduce the intensity of labor, save on workforces, and better advance toward in-depth and in-breadth production, to carry out farmland capital construction better, to guarantee consistently high yields, and to promote all-around development of economic diversification, it is necessary gradually to upgrade the extent of mechanization.

In view of the province's complex types of soil, the multiplicity of agricultural sectors, and the diversity of crops, mechanization of agriculture will have to suit general methods to specific circumstances, and there will have to be comprehensive planning, and arrangements that take all factors into account. The main effort will have to be on supplying complete sets of equipment for paddyfield mechanization, while at the same time efforts will have to be made to mechanize mountainlands, drylands, and the animal husbandry, sideline occupation, and fishing industries.

1. Paddyfield machines: In addition to improving transplanting, plant protection, and harvesting equipment, emphasis should be placed on research and development of powered equipment suited to paddyfield cultivation. Most of the tractors used in paddyfields today have caterpillar treads that increase the depth of paddyfield mud bottoms over the years and damage the cultivated layer. Research to improve designs must be carried out so that moving machines and associated equipment will not sink into the fields and will not deepen the plow layer. Plowing boats and power boats already developed to till paddyfields should be actively promoted and used. Ideally both plowing and harrowing should be done in a single operation to upgrade work efficiency. Research, development, and promotion should be done on transplanting machines, boyangji [2328 4441 2894], cultivators, deep fertilizing drills, and hand tractor accessories. Mutually applicable experiences and production techniques for agriculture and machinery should be explored. A beginning should be made with reform of the farming system as, for example, the growing of green manure-pulses-paddy rice, and further farmland capital construction for rotation of wetland and dryland crops, lowering of ground water tables, and draining of water to dry fields and increase the soil's bearing capacity, to set the stage for machine cultivation and machine harvesting. In addition to the growing of green manure as a catch crop in paddyfields, the area planted to rape and broad beans should be expanded, or else some high yield green manure should be cut and composted for use on other fields and left as fertilizer for the late paddy crop, all of which would help machine cultivation.

2. Dryland crop and mountainland machines: Drylands account for 20 percent of the province's total cultivated land area. With the spread of a three crop dryland grain system, potential for increased yields is very great; however an increasingly large workforce is also required. Today there are

very few kinds of farm machines for working mountain and hill areas, or dryland crops; the extent of mechanization is extraordinarily weak and earliest possibly research and development should be done on suitable small tractors and associated equipment.

3. Drainage and irrigation machines: The present emphasis should be on research and development of the pumps capable of lifting water from 70 to 150 meters that are needed in mountain regions, and to the low elevation large flow pumps needed in the lake region to drain large-scale waterlogging and to fight against large-scale drought. Moreover, general methods should be suited to specific circumstances to research and development of automatic intake pump systems and spray irrigation machinery.

4. Farmland capital construction machines: Active research and development of tractor-powered soil loosening, bulldozing, soil leveling, earth scraping, desilting, earth embankment building, drilling, and rock hauling machines to meet needs for mechanization, electrification, soil improvement, and building of a garden style farming. The lake region also needs a certain number of dredges.

5. Hauling machines: As agricultural production develops, the volume of transportation will become increasingly great, and it will be necessary to import and to develop a series of self-dumping towed vehicles, to actively develop diesel engines for farm use, farm vehicles, outboard motors for boats, and mountain region cableway transportation.

6. Forestry machines: Hunan has vast mountains and numerous forest regions. Efforts should be made to upgrade the extent of mechanization of forest operations such as preparing the land for afforestation, restoration and care of forests and replacement of cut over areas, and to solve the problem of machines for digging holes, pruning branches, and for plant protection in forest areas. Machines for the felling of timber and hauling it to central points should be actively developed.

7. Animal husbandry machines: The raising of hogs and cattle, and the growing of poultry in Hunan Province have developed fairly rapidly. It is necessary to continue to perfect dry feed pulverizing machines, green feed chopping machines, and pulping machines suitable for use on state-owned farms and for use by communes and brigades. There should be gradual development of mechanized and automatic feeding of livestock and poultry.

8. Fishing industry machines: Efforts should be made to upgrade the mechanization of breeding. All sorts of machines for catching fish, as well as quick freezing and cold storage machines, and machines for simple processing and transportation of fish products should be researched and developed.

Efforts should be made to proceed from the existing foundation toward continued improvement of machines for the processing of agricultural sideline products and for harvesting, and of things such as chemical fertilizer, pesticides, and plastic film used in agriculture in order to increase production and satisfy needs.

3. Agricultural Geography Zones

The special material production process known as agriculture is characterized by long cycles and strong seasonality. In addition, the soil is its main object of work and means of production. Any increase in area as an arena for production activities is very much affected and limited by natural conditions and socioeconomic conditions. Various conditions in different areas differ in thousands of ways and are very dissimilar. Objectively speaking, agricultural production is strongly regional. Comrade Mao Zedong has pointed out that "It is necessary to suit general methods to local situations. Agriculture differs from place to place and from time to time, and the direction of its development differs too. In directing agriculture, it is necessary to take into account the different regions and adopt different methods..." ("Economic Problems and Financial Problems"). In our development of agricultural production, this has pointed the way toward the necessity for doing comprehensive planning, suiting general methods to local situations, and providing tailored guidance on the basis of local characteristics.

Hunan Province is an intermediate sub-tropical region with a vast area that covers about five degrees of latitude and longitude. Its light, heat, water, and soil resources are limited and redistributed by a horse hoof-shaped topography. Its natural characteristics are manifested not only in differences among the surrounding mountain regions and central basin as well as the northern plains, but are also evidenced by striking differences between west and east. The differences in these natural areas of east, west, south, north, and central on a provincial scale objectively provide an important geographical foundation necessitating a zonal pattern for development of agricultural production.

The selection, use and transformation of nature that the working people have been engaged in over a long period of time has been reflected in the handling of the soil within the province, which has been developed historically from north to south and from east to west. In ancient times there was an administrative system of Changsha in the east and Qianzhong in the west, and there was also "Southern Hunan" (during Qin and Han times), and "Eastern Hunan" and "Western Hunan" (during the Three Kingdoms period and during the period of eastern and western Qin), and "Central Hunan" (during Qin). Though the size of the regions at that time was utterly different from the present, the position of the Xiang Jiang valley as the hub came about long ago, and the four regions connected to it gradually developed around it. With the historical evolution of production and society, the current popular concept of "western Hunan" came to mean largely the mountain regions to the west of the eastern foothills of the Xuefeng Shan. "Eastern Hunan" means the parallel mountain and valley region to the east of the Xiang Jiang valley, and "southern Hunan" means the Wuling Shan hill region. The Changshan-Hengyang and the Lianyuan-Shaoyang hill basin among the three is "central Hunan." The lower reaches of the four rivers, and the plain around the lakes is known as "northern Hunan." Though these large tracts carry on and reflect traditional historical administrative regions, in reality, they also hold real significance for zoning as different areas for development of agriculture.

In short, the characteristics of agricultural production and the level of development of any given region is the result of an intermixture of natural and economic factors under active intervention by mankind's farming activities. Conditions vary in different areas, and farming methods and results derived from them differ too. This must inevitably be reflected in differences among one agricultural region and another. Zoning based on these regional differences not only reveals the regional conditions and features of agricultural production, but, more importantly, permits mastery of the different characteristics of each area, makes it possible to make the most of strengths while avoiding weaknesses, and to use advantages to the full for rational crop patterns, planned agricultural production, and active building of modernized socialist agriculture.

The whole province's category 1 agricultural regions may be basically zoned on the basis of the following three principles:

First, overall similarities of continuous tracts in a region in terms of agricultural production characteristics, and natural and economic conditions.

Second, relative identicalness within a region of the direction of agricultural development and major technical reform measures.

Third, maintenance intact of county level administrative boundary lines.

Using the foregoing principles to study historical traditions, the entire province was preliminary zoned into four major agricultural regions, namely northern Hunan, central Hunan, southern Hunan, and western Hunan.

Since differences exist not only within the major regions, because soil types in individual major regions are fairly complex, and since the pattern, present levels, and course of development of farming, forestry, animal husbandry, sideline occupations, and fisheries are not entirely the same, zoning as a single category does not adequately show regional agricultural diversity, nor is it conducive to adoption of rational readjustments or selective planning for agricultural sectors within specific areas. For example, the western Hunan zone straddles two large mountain ranges and three river basins, covers about 4 degrees latitude from south to north, and conditions in northwestern Hunan differ very greatly from those in southwestern Hunan. Central Hunan straddles the two great water systems of the Xiang and Zi rivers, and both the terrain and make-up of the soil also varies east and west. Agricultural production and capital construction are by no means an integral whole in the southern Hunan surrounding mountain region and the basins among the mountains, or on the plains around the lakes of northern Hunan and the hills around the lakes. Even though development of production within a large region may be virtually identical, in order to do things in accordance with the principles of "suiting general methods to specific circumstances and having proper concentration," study has been made of definite agricultural regional types within the region. Both key elements and the pattern of marketable product production bases have been analyzed, and key problems and major ways of solving them have been explored, category 1 zoning used as a basis for trial zoning of sub-regions. The whole province has thus been divided into four category 1 zones (Table II-20), and 14 sub-zones (Figure 17).

I. Northern Hunan Agricultural Zone

1. Lakeshore plain grain, cotton, and aquatic products sub-zone

2. Lake circumferential hills grain, oil, and tea sub-zone

II. Central Hunan Agricultural Zone

1. Eastern Hunan mountainland and hill grain and forest sub-zone

2. Changsha-Hengyang Basin grain, hog, and suburban agricultural sub-zone

3. Lianyuan-Shaoyang hill grain, breeding, and horticultural sub-zone

III. Southern Hunan Agricultural Zone

1. Northern hill grain, oil, and fruit sub-zone

2. Central basin grain, and cash crop sub-zone

3. Southeast mountain forest and grain sub-zone

4. Southwest mountain forest and grain sub-zone

IV. Western Hunan Agricultural Zone

1. Wuling mountainlands dryland grain, economic forest, and animal husbandry sub-zone

2. Yuan and Zi rivers middle reaches mountainland forest and tea sub-zone

3. Yuan Shui middle reaches valley, grain, horticulture, and fish breeding sub-zone

4. Yuan Shui upper reaches mountainland grain, and timber sub-zone

5. Zi Shui upper reaches semi-mountain, semi-hill grain, forestry, and hog sub-zone

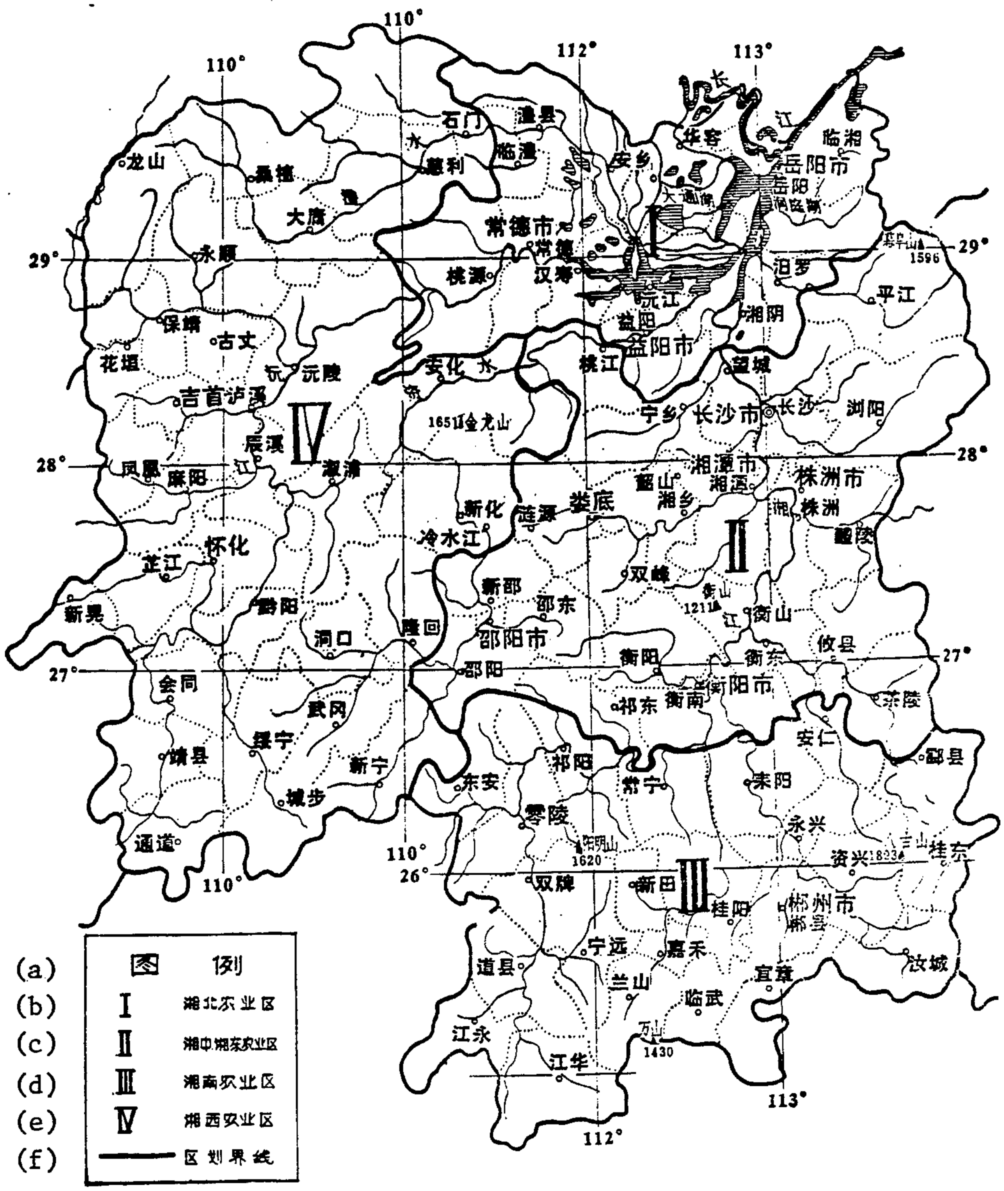


Figure 17. Hunan Agricultural Region Zone Map

Key:

a. Legend
b. I. Northern Hunan agricultural zone
c. II. Central and eastern Hunan agricultural zone
d. III. Southern Hunan agricultural zone
e. IV. Western Hunan agricultural zone
f. Zone boundary

Statistics on Basic Situation in Agricultural Sub-Zones of Hunan Province (1979)

		(a) 单位	(b) 全省合计	湘北 (c) 农业区	占全省 (d) %	湘中 (e) 农业区	占全省 (d) %	湘南 (f) 农业区	占全省 (d) %	湘西 (g) 农业区	占全省 (d) %
(h)	面积	(al) 平方公里	211849	30199	14.25	53310	25.16	48534	22.91	79806	37.67
(i)	县（市、镇）数	(am) 个	105	18	17.5	29.0	27.6	25	23.8	33	31.4
(j)	公社数	个	3304	457	13.83	1111	33.63	720	21.79	1016	30.75
(k) 人口	(l) 合计	(an) 万人	5223.05	1011.54	19.37	1989.74	38.10	965.30	18.48	1256.47	24.06
	其中：(m) 农业人口	万人	4616.50	897.73	19.45	1688.93	36.58	875.26	18.96	1154.58	25.01
(n) 耕地	(l) 合计	(ao) 万亩	5160.60	1271.59	24.64	1657.68	32.12	934.06	18.10	1297.27	25.14
	其中：(o) 水田	万亩	4034.40	953.63	23.64	1387.28	34.38	756.41	18.75	937.08	23.23
	(p) 旱土	万亩	1126.20	317.96	28.23	270.40	24.01	177.65	15.78	360.19	31.98
(q) 旱涝保收面积	(l) 合计	万亩	3309.05	916.89	27.71	1159.55	35.04	607.02	18.34	625.59	18.91
	(r) 占耕地面积	%	64.12	72.11		69.95		64.99		48.22	
	其中：(s) 高产稳产农田	万亩	2268.93	640.82	28.24	856.43	37.75	420.65	18.54	351.05	15.47
(t)	农作物总播种面积	万亩	12501.65	3288.25	26.30	4208.77	33.67	2065.33	16.52	2939.48	23.51
(u) 粮食作物	(v) 播种面积	万亩	8556.32	2080.55	24.32	2822.80	32.99	1491.12	17.43	2161.90	25.27
	(v1) 占用耕地	万亩	4387.07	989.39	22.55	1443.77	32.91	831.85	18.96	1122.18	25.58
	(w) 亩产	(ap) 斤	1011	1086		1165		907		824	
	(x) 总产	亿斤 (aq)	443.62	107.46	24.22	168.27	37.93	75.46	17.01	92.46	20.84
	(y) 77~78年度商品粮	亿斤	76.82	24.48	31.87	28.37	36.93	11.61	15.11	12.36	16.09
(z) 稻谷	(v) 播种面积	万亩	6760.29	1740.36	25.86	2491.66	36.86	1231.80	18.22	1283.54	19.06
	(w) 亩产	斤	592	570		634		567		563	
	(x) 总产	亿斤	400.03	99.69	24.92	157.89	39.47	69.85	17.46	72.54	18.13
(aa) 经济作物	(v) 播种面积	万亩	960.83	365.01	37.99	267.72	27.86	103.81	10.80	224.32	23.35
	(v1) 占用耕地	万亩	499.32	221.12	44.28	96.93	19.41	69.40	13.90	111.87	22.40
(ab) 棉花	(v) 播种面积	万亩	241.23	154.19	63.92	39.51	16.38	17.92	7.43	29.60	12.27
	(w) 亩产	斤	78	88		52		42		77	
	(x) 总产	万担 (ar)	187.44	136.45	72.80	20.73	11.06	7.52	4.01	22.75	12.14
(ac) 油菜籽	(v) 播种面积	万亩	459.09	144.54	31.48	175.09	38.14	17.82	3.88	121.67	26.50
	(w) 亩产	斤	100	108		89		68		110	
	(x) 总产	万担	457.40	156.06	34.12	155.97	34.10	12.10	2.65	133.29	29.14
(ad) 牲猪	(ae) 全年饲养总数	(as) 万头	3745.96	750.08	20.02	1505.56	40.19	627.30	16.75	863.02	23.04
	(af) 年末存栏数	万头	2120.47	450.85	21.26	817.69	38.56	335.88	15.84	516.05	24.34
	(ag) 全年出栏数	万头	1625.49	299.23	18.41	687.87	42.32	291.42	17.93	346.97	21.35
(ah)	林地面积	万亩	10905	880	8.07	2803	25.70	3105	28.47	4217	38.67
(ai)	柑桔产量	万担	122.44	21.99	17.96	44.85	36.63	14.62	11.94	40.98	33.47
(aj)	茶油产量	万担	115.59	10.31	8.92	38.06	32.93	45.23	39.13	21.99	19.02
(ak)	桐油产量	万担	19.15	0.54	2.82	1.13	5.90	0.86	4.49	16.62	86.79

Note: 1. Source of data: Provincial Statistical Bureau 1979 Annual Statistical Report.

2. Figures for some farms and some agricultural research units have not yet been made a part of statistics; thus, a slight discrepancy exists for individual items in provincial totals and corresponding total figures for agricultural regions.

3. Marketable grain figures are for 1977-1978.

[Key on following page]

Key:

a. Units
b. Total for the province
c. Northern Hunan agricultural region
d. Percent of whole province
e. Central Hunan agricultural region
f. Southern Hunan agricultural region
g. Western Hunan agricultural region
h. Area
i. Number of counties (cities and towns)
j. Number of communes
k. Population
l. Total
m. Including: agricultural population
n. Cultivated land
o. Including: wetlands
p. Drylands
q. Area that assures a harvest despite drought or waterlogging
r. Percentage of cultivated land area
s. Including: consistently high yield farmland
t. Total area sown to farm crops
u. Grain crops
v. Sown area
v_1. Percent of cultivated land in use
w. Yield per mu
x. Gross output
y. Marketable grain 1977-1978
z. Paddy rice
aa. Cash crops
ab. Cotton
ac. Rapeseed
ad. Hogs
ae. Total fed for the year
af. Year-end number in inventory
ag. Number removed from inventory during year
ah. Forest area
ai. Citrus output
aj. Tea oil output
ak. Tung oil output
al. Square kilometers
am. Units
an. 10,000 persons
ao. 10,000 mu
ap. Jin
aq. 100 million jin
ar. 10,000 dan
as. 10,000 head

Part II

Chapter 3. North Hunan Agricultural Region

The North Hunan Agricultural Region is located in the northern part of the province and includes 14 counties and four municipalities as well as 15 state-owned farms in Yueyang, Yiyang, and Changde prefectures totaling 45,297,800 mu, or approximately 14.3 percent of the province's total area. This includes a cultivated land area of 12,715,900 mu, or about 24.6 percent of the province's total cultivated land area. This is the smallest of the province's four agricultural regions, but the one in which the reclamation and cultivation rate is higher and development of agricultural production faster than in the others.

The northern Hunan Dongting Hu region is part of the plain in the middle reaches of the Chang Jiang, and has been commonly known as a "land of fish and rice." Since the founding of the nation, in normal harvest years this region has provided 25 percent of the province's total grain output and 30 percent of its marketable grain, 70 percent of total cotton, 40 percent of total oil-bearing crops, and 80 percent of total hemp, as well as about 50 percent of total aquatic products. It is an important production base for the province's farming and fishing industries.

Second Section. Types of Agricultural Regions and Base Construction

The concentric circle structure of northern Hunan's mountains, hills, plains, and lakes forms the objective foundation for the zoning of four agricultural region types. It provides objective conditions for laying out separate production patterns based on disparate laws governing zoning of different regional types and the building of bases by adapting general methods to specific situations.

1. Zoning Types of Agricultural Regions

The entire region may be divided into two sub-regions and four kinds of land areas (Figure 29 [not reproduced]) in terms of kinds of soil (Table 50), and relatively identical production conditions and characteristics of communes that form a continuous tract.

Table 50. Northern Hunan Soil Types and Area by Area Soil Characteristics

(a) 类型区	(b) 范围	(c) 地貌					(d) 土壤			(e) 温度 ℃				(f) 水分		
		(g) 类别	(h) 物质组成	(i) 绝对高度（米）	(j) 相对高度（米）	(k) 坡度	(l) 名称	(m) 土层厚度（厘米）	(n) 有机质（%）	(o) 年平均	(p) 一月	(q) 七月	(r) 无霜期（天）	(s) 年降水（毫米）	(t) 地表水（毫米）	(u) 地下水
I 中部河湖围田区 (v)	安乡、南县全部，常、澧东部，汉、沅、益东北部，华容南部，湘阴、汨罗、岳阳的西部湖区以及临湘的沿江部分 (z)	河湖沉积水网平原 (ad)	冲积湖积层 (ah)	<40	0—3	1°—5°	冲积土——潮沙泥、青泥田 (an)	80-150	1.8—3	16.5	4.2	29	280	1250	600—800（客水充沛）(at)	埋深0.5—1.5米钻孔单位涌水量15吨/时米 (av)
II 滨湖岗地坪田区 (w)	常、澧、华、汉中部，益、沅一带，湘、汨、岳滨湖和临澧北边，桃源局部 (aa)	河漫滩平原与阶地 (ae)	冲积红土砂砾层 (ai)	40—70	5—60 不等 (am)	5°—15°	冲积土红壤——沙泥、黄泥田 (ao)	30—80	1.5—2	17	4.3	29.3	275	1350	同上 (au)	0—5米 5—10吨/时·米 (aw)
III 环湖丘陵垄冲田区 (x)	常、汉南部及西北澧县西部、益阳中部和以南，湘、汨、岳中部和东部，华容北边，临湘和临澧、桃源的大部 (ab)	侵蚀剥蚀波状丘陵 (af)	板岩、砂页岩、红岩、部分花岗岩等及其风化层 (aj)	>70	>60	15°—30°	红壤——黄泥、青夹泥，沙泥田 (ap)	30左右 (ar)	2左右	16—16.5	4.5	28.7	270	1450	700—1000	0—15米 1—5吨/时米 (ax)
IV 外围低山冲田区 (y)	与丘区相接之东北、西南及西北外缘部分 (ac)	构造剥蚀断续低山 (ag)	板岩、千枚岩花岗岩以及砂页岩 (ak)	>500（有的峰高达1000）(al)	400—800	>30°	基本同上 (aq)	一般<30部分基岩裸露 (as)						>1500	800—1100	<1吨/时米 (ay)

[Key on following page]

Key:

a. Area classification
b. Coverage
c. Terrain
d. Soil
e. Temperature °C
f. Water
g. Category
h. Material composition
i. Absolute elevation (meters)
j. Relative elevation (meters)
k. Gradient
l. Designation
m. Soil thickness (centimeters)
n. Organic matter (%)
o. Annual average
p. January
q. July
r. Frost-free period (days)
s. Annual precipitation (millimeters)
t. Surface water (millimeters)
u. Ground water
v. I. Central river and lake diked field area
w. II. Lakeside downlands flat field area
x. III. Ridge alluvial field zone in hills around lake
y. IV. Alluvial field zone in low mountains in outer perimeter
z. All of Anxiang and Nanxian counties; eastern Changde and Lixian counties; northeastern Hanshou, Yuanjiang and Yiyang counties; southern Huarong County, western lake area of Xiangyin, Miluo, and Yueyang counties, and portion of Linxiang county along the river
aa. Central Changde, Lixian, Huarong, and Hanshou counties; area from Yiyang to Yuanjiang; lakeshore of Xiangtan, Miluo and Yueyang counties and northern part of Linwu and Lixian counties, and portions of Taoyuan County
ab. Southern and northwestern Changde and Hanshou counties, western Lixian County, central and southern Yiyang County, central and eastern Xiangtan, Miluo, and Yueyang counties, the northern edge of Huarong County; Linxiang County, and most of Linli and Taoyuan counties
ac. Portions of the northeast and southwest contiguous with the hill region, and parts of the northwestern outer perimeter
ad. Water-laced plain of river and lake sediment
ae. River flood plain and terraces
af. Undulating corroded and eroded hills
ag. Corroded faulted low mountains
ah. Alluvial lacustrine layer
ai. Alluvial red soil and boulder bed
aj. Slate, sandy shale, red rock and some granite as well as a weathered layer of all
ak. Slate, phyllite, granite, and sandy shale
al. >500 (with some peaks as high as 1,000 meters)

am. Varying from 5-60
an. Alluvium-sandy chao soil, and qingni soil
ao. Alluvial soil and red soil-sandy soil, and huangni soil
ap. Red soil-huangni, intercalated qingni, and sandy soil
aq. Virtually the same as next above
ar. About 30
as. Generally <30 parts of bedrock exposed
at. 600-800. Copious foreign water
au. Same as above
av. 0.5-1.5 meters deep, with a flow of 15 tons/per hour per meter from drilled holes
aw. 0-5 meters deep, with a flow of 5-10 tons per hour per meter
ax. 0-15 meters deep with a flow of 1-5 tons per hour per meter
ay. <1 ton per hour per meter

(1) The Lake Plain Grain, Cotton, and Aquatic Products Sub-Region

I. Lake Region Protective Embankment Grain, Cash Crop, and Aquatic Products Regional Type

The eastern, western, southern Dongting Hu and the Datong group of four lakes are found on the lacustrine alluvial plain of the central part of northern Hunan. The area is crisscrossed with rivers and streams; the land is flat and vast, and apart from scattered downlands, natural embankments, large embankments and turret lands, most of the land is around 35 meters above sea level, and the relative height is 3-5 meters. Lowlying land between rivers is even lower than the surface of rivers and lakes and is marshy.

This zone type includes 145 lake region people's communes in 12 counties and 15 state-owned farms under jurisdiction of the province. Major characteristics are as follows: (1) Cultivated land is greatest in this zone (amounting to about 42.5 percent of the total region). Wetlands and drylands received equal emphasis in the structure of soil utilization (accounting respectively for 42 percent and 48 percent of the cultivated land area in the region). The zone is also characterized by concentrated continuous tracts of fields reclaimed from the lake and lake lowlands that are laid out in the shape of a net over a large area and protected by embankments. (2) This is a major production zone for grain, cash crops, and aquatic products. Grain is grown on 38.4 percent of the zone's cultivated land area and produces 40.5 percent of total grain output for the region, the marketable rate being 30-35 percent. Cotton is grown on 52 percent of the zone's cultivated land and produces 52 percent of output for the region, the marketable rate being more than 90 percent. Production of various kinds of hemp is particularly concentrated. Various kinds of hemp are grown on 86 percent of the zone's total sown area, and accounts for 70.8 percent of output in the region. Nanxian and Yuanjiang lake region counties people's communes produce 57 percent of all hemp grown in the region. Ninety percent of all communes in Nanxian produce more than 1,000 dan of choice jute annually, and 53 percent of all communes in Yuanjiang County produce more than 500 dan of ramie. Sugarcane is grown on 83.2 percent of the zone's cultivated land and accounts for 84.3 percent of output in the region, most of it from state-owned farms. Because of the

large number of lakes that dot the area and the density of the river network, output of aquatic products is fairly abundant. The region has three fishery communes that catch fish. (3) The population is sparse relative to the amount of farmland, cultivated land averaging 1.6 mu per capita of agricultural population, and each member of the workforce farms an average of more than 4 mu. This task plus the annual job of repairing dikes against floods places a fairly heavy burden on the workforce. (4) As a result of intensified natural silting in Dongting Hu, a flood threat exists. In view of the foregoing characteristics and existing production levels, this type region must continue to devote efforts to preventing floods and draining away waterlogging, to the building of water conservancy projects for comprehensive control of rivers and lakes, to expansion of the area of garden style farming and mechanized farming, to continued consolidation and improvement in marketable grain and cotton bases, to more growing of rape and hemp crops, and to development of silkworm mulberry. Simultaneous with efforts to increase gross output and yields per unit of area should be rational development of lake flats surrounded by water and full use of existing water surfaces for development of the fishing industry as well as for production of Hunan lotus.

This zone type may be divided into four class 2 types: I-1, the Changde, Yiyang, Yueyang type (with equal emphasis on grain and cotton production and the linking of grain and oil-bearing crop production). I-2, Yuanjiang-Huarong type (grain, oil-bearing crops, cotton, and hemp). I-3, provincial farm type (grain, cotton, and sugarcane). I-4, Dongting Hu type (mostly fisheries).

II. The Lakeside Plain Grain, Cotton, and Breeding Region Type

The lakeside and river shore Quarternary System constructional zone has a terrace and hill topography, and is made up of mostly red clay and boulder bed. Relative variations in elevation range from 10-70 meters, and elevations may be divided into roughly four grades. This includes 15-25 meter second terraces, which are fairly well developed to the south of the mouth of the Yuan Jiang and the eastern bank of the eastern Dongting Hu. The surface of the land is cut up, but the land is gently rolling. Numerous streams cut across the downlands and the fore-fringe producing flat silt lands. Most of the flood plain near the mouths of rivers was formed by continuous accumulations up until 1825. It varies in elevation from between 5 and 7 meters during the period of normal water level, and the threat of flooding is not great.

This zone type includes 57 people's communes in 10 counties (and municipalities) ringing Dongting Hu and the lower reaches of the four rivers. Agriculture here has the following features: (1) Broad, flat fields and ridge soil is found in bands, and accounts for 14 percent of total cultivated land in the zone. The land is used predominantly for wetlands, with emphasis given both wetlands and drylands. Wetlands and drylands account respectively for about 13 and 16 percent of the zone. Cultivated land averages 1.2 mu per capita, and each member of the workforce is responsible for farming about 2.9 mu. The workforce cannot yet be said to be fully

ample. (2) The degree of intensivity and yields per unit of area are fairly high, with more than 80 percent of cultivated land growing three crops, principally two crops of rice and one of green manure, or two crops of rice and one crop of rape, or two crops of rice and one crop of wheat or barley. Drylands intercrop cotton (or sweet potatoes) and rape, pulses, or wheat and barley. Communes having yields of more than 800 jin per mu of grain in 1975 numbered 87.7 percent of all communes, with 35 percent of that number producing more than 1,000 jin per mu of grain. Communes producing 80 jin per mu of cotton numbered 61.4 percent of all communes in this zone type, with 38.6 percent of them having yields of more than 100 jin per mu. By comparison, this was not only vastly more than for hill regions, but was also in first place for the lake region. The marketable rate for grain output was 25 to 30 percent; for cotton, it was about the same as for the lake region as a whole. (3) This zone type is developing the growing of tea and fruit that are little grown in the lake region but much grown in the hill region. Because of the numerous cities, towns, and industrial plants, this is an area with much water and land transportation, and of flow back and forth between cities and countryside. Suburban vegetable growing, hog and fish breeding, hauling, and processing of agricultural sideline products is fairly well developed. (4) Most of this zone type's farmland is higher than river and lake surfaces except for some where dikes have been built to guard against flodding, which is prone to waterlogging during the rainy season. Water must be lifted or diverted for irrigation during the dry season, and water conservancy measures emphasizing irrigation, but linking irrigation and drainage have been adopted. Currently the cultivated land area guaranteed to yield a harvest despite drought or flood totals 77.6 percent of all cultivated land.

It is necessary to continue to consolidate and develop production of grain, cotton, and oil-bearing crops in this zone type, to strive to increase yields per unit of area in combination with development of tea and fruit production. More fertilizer must be used and water conservancy works built to produce consistently high yields. This region may be divided into the following four class 2 types: II-1, the Changde-Yiyang-Yueyang type (grain, cotton, oil, and tea); II-2, Huarong-Hanshou type (grain-cotton, oil-bearing crops, and hemp); II-3, the Liyang-Yuanpu type (cotton growing area); and the II-4 four cities type (grain, vegetables, hogs, and fish).

(2) The Grain, Oil, and Tea Sub-Region in the Hills Surrounding the Lake

III. Zone Type of Hill and Alluvial Valleys Near Lakes That Produce Grain, Tea, and Pork

Between the plain and low mountains on its fringe lies a broad expanse of slate, sandy shale, red rock and some granite. The sandy shale and limestone make up gently sloping low hills 100 to 400 meters high. Upright outcroppings of old hard rock adorn the landscape around Shending, Yuchi, Jinniu Shan, Taiyang Shan, Taifu Shan, and Taohua Shan. Hill region alluvial valleys alternate with partial basins, and there are diverse kinds of wetlands. The slopes of hills grow mostly dryland crops and tea and rape; but there are many bald mountains and much wasteland.

The foregoing hill type applies to 226 hill zone communes in 12 counties, whose principal characteristics are as follows: (1) The surface of the land undulates gently and the fields contain fairly diverse kinds of soil. The amount of cultivated land is about the same as in the lake region, but wetlands account for 44.5 percent of the area, and drylands account for 32 percent. Cultivated land in the river valley plains and nearby gently sloping areas is fairly concentrated and lies like the branches of a tree. It may be divided into ridged fields (duan tian [0641 3944] and flat fields), alluvial fields (rong tian [3310 3944] and yu tian [8230 3944]), as well as shoaly fields (drained fields [2226 3944] and shore fields), ridge soil, and slope soil. Soil and moisture conditions are diverse. Generally, water sources are lacking, and the area is prone to drought during the dry season. Water conservancy consists primarily of impounding water in ponds and reservoirs, and the use of impounded water, diversion and raising of water for irrigation. Many farming systems have been adopted as a result of these conditions, with the growing of two crops of paddy and one crop of green manure being the system used in an overwhelming percentage of cases. There is some growing of rice-rice-oil-bearing crop, or of rice-rice-wheat or barley in a three crop system. There is also some growing of one crop of intermediate paddy or late paddy and one winter crop (or intercropped winter crops) on drylands, mostly tubers, gaoliang, and pulses being grown. Some cotton, rape and sesame crops are also grown. (2) Area sown to grain and gross output of grain from this zone account for 45 and 43 percent of the total for the region. Mostly paddy rice is grown, but more dryland sweet potatoes and gaoliang are grown than anywhere in the whole region, and a substantial potential exists for increased yields. For example, Jieling Commune in Li County planted more than 7,000 mu of gaoliang in 1975, or 17.5 percent of the total planted in the county. In the same year, the commune's output of grain totaled 35 million jin, which was again as much as the 1974 output. This included 300,000 jin from 17 households in Fusheng Ninth Brigade, each household contributing 10,000 jin of grain to the state. Two crops of gaoliang from 15 mu in Jinluo Brigade averaged yields of more than 2,400 jin per mu. The masses said that dryland grain had been a big help in a major rise in grain output. This zone's output of cotton has declined relative to that of the previous zone. It is grown over a dispersed area, the area sown amounting to 25.7 percent of the total for the whole region and gross output to 24.7 percent. (3) The area has a history of tea production, which has developed very rapidly. As of the end of 1975, the actual tea plantation area was more than 570,000 mu, and gross output was 250,000 dan, accounting for 95 and 92 percent respectively for the whole region. Linxiang County alone had more than 100,000 mu of tea plantations and a tea output of 88,800 dan, one-sixth of the whole region's tea plantation area, and one-third of gross output. A more than 1,800 mu demonstration tea farm on both sides of the railroad to the east of the county seat lost none of its capital since the farm was established in 1966, and in 1976 had an income of more than 200,000 yuan. Luoping Brigade in Taolin Commune had an income of 50,000 to 80,000 yuan for 1975 and 1976 from a 600 mu tea farm. Hanshou, Yiyang, Xiangyin, Taoyuan, Yueyang, and Miluo counties also produced a lot. Most of northern Hunan's tea oil is also found in this type zone. In 1975, tea oil output was more than 84,600 dan, with Changde hill zone and Taoyuan producing a total of more than 56,500 dan. Hanshou also produced almost 10,000 dan;

Linli produced 6,500 dan; Yiyang produced 4,300 dan, and all other counties produced relatively less. Forestry has developed unevenly. The more than 100,000 mu of forests in the whole province are divided into five bases including Zhifang Shan, Shibaluohan Shan, Jiulong Shan (which grow mostly Chinese fir and sassafras), Nitou Shan (tea oil) and Zhuyuan (nan bamboo). Hill zone communes in all other counties have also devoted major efforts to afforestation and planting of trees. (4) Cultivated land averages 1.37 mu per capita, each member of the workforce being responsible for 3.3 mu. Since the cultivated land is dispersed over a fairly wide area, and since drought must be fought on part of it during the dry season while the rainy season brings scouring and silting, quite a large amount of work has to be done. But the total workforce can be turned over. Tea processing, and breeding of poultry, hogs, and fish, as well as quarrying and mining are thriving sideline occupations.

This type zone must strengthen soil improvement and the harnessing of water, increase sources of fertilizer, and continue to increase the extent of intensive production. It has to turn low yields into high yields and balance large increases in yields. It must increase tea output, produce more tea oil, and develop both firewood and timber forests. This zone may be divided into three secondary types as follows: III-1, Xiangtan-Yueyang-Yiyang-Lixian (grain, oil, and tea) type; III-2, Changde-Taoyuan (grain, oil, tea, and forest) type; and III-3, Yuanjiang-Huarong (grain, hemp, and fruit) type.

IV. Perimeter Low Mountain and High Hill Forest, Animal Husbandry, and Grain Region Type

This region is the border counties of Linxiang, Yueyang, and Miluo in the east, and is a folded mountainland composed of phyllite, slate, and granite that includes Yaogu Shan, Yun Shan, and Meimaojian at an elevation of about 1,000 meters above sea level. This mountainland is an extension of the Mufu mountain range, and is a region of sudden rise on the east of the plain of the two lakes. It controls the westward flow into the Dongting Hu of the Xinqiang He and the Miluo Jiang. To the southwest in Taoyuan County lie Tiantai Shan, Guniu Shan and the mountainlands of the western part of the county, most of which are formed of slate, phyllite, and sandy shale and are at an elevation above sea level of 500 to 1,000 meters. In northwestern Lixian County may be found sandy shale hills below 700 meters in elevation. These mountainlands have been corroded and eroded for a long period of time and have undergone afforestation. The forest cover rate is fairly high.

The foregoing type zone includes 27 mountain region communes in five counties in Yueyang and Changde prefectures, which are located on the northeast, southwest, and northwest borders of the region. (1) Cultivated land is least of all the zones (amounting to 2.78 percent of the whole region), and drylands are more numerous than wetlands (accounting for 3.7 percent of drylands and 2.4 percent of wetlands in the region). Mountainlands are more numerous than cultivated land, averaging about 15 mu per capita of agricultural population versus 1.15 mu of cultivated land. Each member of the workforce is responsible for farming 2.9 mu of cultivated land. (2) Most farming is done on terraced hillsides, which are spread over a wide area, and which are much

affected by mountain shade and cold waterlogging. There is no general shortage of water, irrigation being provided mostly by ponds, reservoirs, and the diversion of mountain streams. This irrigation should be used in combination with control of mountain water and draining of cold waterlogging for vigorous improvement in low yield fields. The most common cropping pattern is two crops of paddy rice and one crop of green manure, except for some fields that depend solely on rainfall and some cold waterlogged mudlands that grow a single crop of paddy (plus a mixture of miscellaneous fall crops in the fields that depend solely on rainfall). Drylands grow mostly sweet potatoes, gaoliang, and corn. Cotton is grown on 0.5 percent of the total area in the region and gross output is 0.30 percent of the total for the region. (3) The mountainlands provide an area in the region for concentrated development of timber forests, and this is also an area in which both grain and forests should be grown, the grain benefiting from forests and the forests promoting the growth of grain. The Maotian district of Yueyang County is more than 60 Chinese li in length and breadth and contains four communes, 67 production brigades, and 44,000 mu of cultivated land, or an average 0.7 mu per capita. Up until the time of liberation, "the mountains were scalped mountains, the water simply passed by, the soil was as thick as the dust on a wall, the fields were sandy shoals in streams, and the hills were pointed cones with sharply sloping sides." Since liberation, under leadership of the party, cadres and masses have harnessed the mountains and waters, improved the soil, and made fields, and in 1975 grain output totaled more than 33.5 million jin, up more than 11 million jin from 10 years previously, with yields averaging more than 1,100 jin per mu. Most of the barren mountains have been made green, with forests covering 70 percent of the area suitable for forests. Growing of Chinese fir, nan bamboo and economic forests, as well as medicinal herbs has been developed. Xiangsi Commune in that region has built 24 joint commune and brigade forest farms, each brigade having four groves (for tea, fruit, mulberry, and bamboo). One of the brigades, Jigu Brigade, took on 1,000 mu of land plus Wanbao Shan. Over the course of several years, it closed off the mountains and replanted trees over a 2,100 mu area of vestigial pine forests to develop a forest canopy over the whole area. More than 800 mu of the newly planted Chinese fir forests has already grown into timber from which benefits are beginning to be derived. Hefan Commune in Linxiang County had more than 3,100 mu of mountain forests, which was only 60 percent of the total available mountainland area. Thanks to active afforestation and diligent care on the part of the masses, more than 9,500 mu were afforested, and the portions that were planted first have already formed a forest canopy and grown into mature timber. Chinese fir, tea, and bamboo cover the mountains with greenery, and the growing of grain and hogs has also developed. Along the Tiantai Shan to Guniu Shan area in Taoyuan County in the west, a very great potential exists for growth of mountain region forests. This type zone is estimated to have a more than 50,000 mu tea plantation area producing 34,000 dan of tea annually. It also has tea oil forests with an annual output of more than 7,000 dan of tea oil. Earnings from tea and forests account for 25 percent of gross income from agriculture.

While developing grain production, full use should be made of mountainlands suitable for forests to develop forestry and medicinal herb production as well

as to start livestock farms for gradual development of animal husbandry. This region may be divided into two secondary types as follows: IV-1, the Linxiang-Taoyuan type (grain, forestry, and tea); IV-2, the Yueyang-Milou-Lixian type (grain, oil, and forestry). (Table 51)

Table 51. Comparison of Individual Areas of the Northern Hunan Agricultural Region Type (1975)

	(a) 分区	(b) 公社 (个)	(c) 农业人口		(f) 耕地					(g) 农作物总播面积	
			(d) 计 (万)	(e) 其中劳动力占人口 (%)	(d1) 计 (万亩)	(h) 旱涝保收面积占耕地 (%)	(i) 其中高产稳产农田占耕地 (%)	(j) 人/劳各占耕地 (亩)	(k) 田/土各占耕地 (%)	(d1) 计 (万亩)	(l) 复种指数
(m)	全区合计	461	877.16	40.78	1267.98	70.78	50	1.44/3.53	75.21/ 24.79	3180.54	259
(n)	湖区	145	329.88	39.27	536.48	78.2	57.4	1.62/4.11	71.68/ 28.32	1234.82	230
(o)	平区	64	138.56	42.52	173.04	79.1	50.7	1.24/2.92	70.05/ 29.95	437.99	253
(p)	丘区	225	377.97	41.51	523.07	62.43	40.7	1.38/3.32	81.14/ 18.86	1432.35	273
(q)	山区	27	30.75	40.24	35.39	41.89	26.3	1.15/2.86	65.79/ 34.21	81.38	231

	(a) 分区	(r) 主要农作物面积产量							(x) 茶叶	(y) 茶油	(z) 牲畜饲养
		(s) 粮食		(t) 棉花		(u) 油菜子	(v) 麻类	(w) 甘蔗			
		(aa) 占总播面%/占总产量%	(ab) 跨《纲要》公社占 (%)	(aa) 占总播面%/占总产%	(ab) 跨《纲要》公社占 (%)	(aa) 占总播面%/占总产%	(aa) 占总播面%/占总产%	(aa) 占总播面%/占总产%	(ac) 面积/占全区产量%	(ad) 产量占全区%	(ae) 头/亩
(m)	全区合计	2019.57(万亩) /885435 (万斤)	77	158.45/ 143(万担)	43.6	93.92(万亩)/ 80.15(万担)	14.38/ 41.17(万担)	8.157/ 465.42(万担)	59.5531/ 26.9555	8.4624 (万担)	0.47/1
(n)	湖区	38.46/40.58	84.13	52.3/52.32	52.41	41.5/40.1	86.275/ 89.57	96.1/97.95	2.23/1.15	0	0.47/1
(o)	平区	13.57/13.62	87.5	21.1/23.03	65.62	18.9/21.75	4.7/3.67	0.49/0.35	7.71/3.62	0	0.62/1
(p)	丘区	45.21/43.21	70.22	26.1/24.32	35.55	38.47/37.3	8.95/6.81	3.39/1.69	81.58/ 87.67	90.64	0.55/1
(q)	山区	2.76/2.59	70.37	0.5/0.33	11.0	1.13/0.85	0.14/0.068	/	8.48/12.56	9.36	0.69/1

Note: These are total figures for area sown and output of grain, cotton, oil, hemp, sugarcane, and tea for the whole region.

Key:

- a. Individual area
- b. Communes (individual units)
- c. Agricultural population
- d. Total (10,000)
- d_1. Total (10,000 mu)
- e. Workforce as a percentage of population
- f. Cultivated land
- g. Total area sown to farm crops

h. Area of cultivated land from which a harvest may be assured despite drought or flooding (%)
i. Cultivated land as a percentage of high and stable yield farmland (%)
j. Amount of cultivated land per capita of population/per capita of workforce
k. Wetlands/drylands as a percentage of cultivated land (%)
l. Multiple cropping index
m. Total for the region as a whole
n. Lake region
o. Plains region
p. Hill region
q. Mountain region
r. Area and output of major farm crops
s. Grain
t. Cotton
u. Rapeseed
v. Hemp
w. Sugarcane
x. Tea
y. Tea oil
z. Livestock raising
aa. Percent of total region sown/percent of gross output
ab. Percentage of communes exceeding "The National Program for Agricultural Development"
ac. Area/percent of gross output
ad. Percentage of total region output
ae. Head per mu

Each of the foregoing four agricultural region types has different environmental conditions and possibilities for improvement. As far as the region as a whole is concerned, similarities and differences in mutual circumstances in individual neighboring regional types, and the degree of relationship and density make the plains area a transitional type between the hill region and the lake region. The mountainland area is not large, so the lake and plains regions are very close to each other, and hill and mountain regions are the same in an overall sense. Thus, using communes as the basic unit, and drawing a boundary line between the plains region and the hill region means the differentiation of two major sub-regions, namely the lakeshore plain and the hills around the lake.

2. Construction and Development of Marketable Product Production Bases

As was said previously, agricultural regional types are an overall reflection of natural conditions and economic circumstances in any given region, and the construction and pattern of distribution of various kinds of production bases are major links in the suiting of general methods to local situations, rational planning of production, making the most of a region's potential, and carrying out intensive operations in corresponding types of agricultural regions. The northern part of the province is an important base for Hunan's production of marketable grain, cash crops, and aquatic products. The current pattern of its production may be characterized in the following several ways:

1. Grain production centering around the growing of paddy rice, and a farming system in which the growing of two or three crops predominates, and has now become a basic pattern. Each of the 14 counties in the region are marketable grain base counties. Though differences exist in production among various regional types, in terms of the situation as a whole, there is comparative balance in the main.

2. There are numerous kinds of cash crops. Though the growing of such crops is somewhat spread out because of local conditions, traditional habits, and marketability, for the most part they are concentrated in the lake and flat land areas. In addition, large cottonfield tracts tend to be concentrated in the west; hemp is concentrated in the central section; sugarcane is concentrated on state farms, and aquatic cash crops such as reeds tend to be grown mostly in eastern lake shallows. Textile, sugar crushing and paper manufacturing industries have been set up near the areas producing these light industrial raw materials.

3. The fishing industry centers around the lake region, in the eastern and southern Dongting Hu and in nearby fish farms. Not only are there communes and brigades specializing in the fishing industry here, but fish procurement and processing stations have also been established nearby. Intensive rearing of fish in ponds and reservoirs has been established and is developing everywhere in this region.

4. Livestock and hog raising plus other sideline production is, in the main, concentrated in the suburbs of cities and towns as well as in hill regions. Small hog farms and poultry farms dot the landscape.

5. Most tea, fruit, and forest production is in the hills around the lakes, where some bases for such production have been set up. These areas have an historical tradition in the growing and processing of tea, which is developing.

In order to meet needs for continuous development of the national economy and for constant raising of the people's standard of living, northern Hunan should continue to devote attention to the growing of grain and cash crops as well as to fishing industry and forestry production, with further strengthening of the building and development of all kinds of commodity bases.

(1) Firm Grip on Grain Production

The current situation in grain production is as follows: high but inconsistent yields in the lake region, both fairly high and consistent yields in plains areas, and consistent but not high yields in hill regions. For the region as a whole, output is fairly high for the lower reaches of the Yuan Shui and Li Shui in the west, as well as for their nearby lake regions; however about 23 percent of all communes still have grain yields that fluctuate around 800 jin per mu. For crops grown in all seasons, a "three low" phenomenon exists (low yields of spring grain, low yields of dryland grain, and low yields of late rice). Furthermore, about 30 percent of the

cultivated land throughout the region cannot be counted on to deliver a crop despite drought or flooding, and garden style farming is practiced on less than one-third of total cultivated land. The threat of drought or waterlogging exists in varying degrees every year. The existing bases should be used for further farmland capital construction centering around soil improvement and harnessing of waters to increase yields per unit of area, and to assure steady increases in grain output.

All counties should energetically transform production conditions. For example, take Anxian County in the waterlaced lake region, which was formerly prone to waterlogging and lived in fear of drought. During the past more than 10 years, it has gone all out to level the land, to practice garden style farming, to renovate and raise the more than 400 kilometers of flood dikes, and to carry out the capital construction of new socialist fields in which "ditches form a network, trees are laid out in rows, and fields are formed into regular size plots within the protective dikes." Now 85 percent of cultivated land is able to deliver a harvest despite drought or waterlogging. In Hanshou County, which cuts across three different agricultural zones, people living in lake regions feared flooding; those in hill regions feared drought, and those on terraced tablelands high above the water in areas crossed by streams feared low water and inability to irrigate their high fields. As a result of mass summarization of experiences and the suiting of general methods to local situations for the building of water conservancy projects, the whole county was able to build 1 mu of fields per capita capable of delivering a harvest despite drought or waterlogging. The county also followed the principles of rational crop patterns and tailored guidance for rapid development of agricultural production. Most of Taoyuan County is in the hill region, and the whole county tackled control of mountains, water, and fields in a comprehensive way. In order to meet the need "to have water available during drought, to drain water during waterlogging, to impound water safely, and to use water scientifically," it built all kinds of water conservancy facilities, renovated and equipped them, and made full use of project benefits for a steady climb in agricultural production.

Rational reform of the farming system is a strategic measure for the launching of scientific farming, and for realization of economic diversification, high yields, and increased income.

Ever since liberation, northern Hunan has steadily reformed its farming system. Its multiple cropping index went from about 180 percent in 1957 to 220-230 percent during the mid and late 1960's, and has risen to around 258 percent in recent years. Statistics for 1979 show grain crops as having been grown on 77.8 percent of the total cultivated land in the region, paddy rice accounting for 84 percent of the grain grown and dryland grain crops for 16 percent. A three crop farming system of two crops of paddy and one of green manure was used in 80 percent of cases, and of rape-rice-rice in 15 percent of cases. Growing of a single crop of rice and a winter crop (or winter intercropping) was done in 5 percent of cases. This demonstrates that a two and three crop farming system for the paddyfields of this area has been put in place and consolidated. Diverse forms of farming have been

adopted to foster a combination of use and nurture of the soil, concern for the short-term and the long-term, and to give attention to matters requiring attention in the paddyfield farming system. This has entailed the growing of rice-rice-green manure, or rice-rice-rape, or rice-rice-livestock fodder. If high yields are to be sustained, wheat or barley, rape, and green manure should not be continuously cropped over a long period of time. These winter crops should be rotated so that strengths make up for weaknesses in the rotation of crops from one year to another. Since one region differs from another, in places where the workforce is not overburdened and where yield levels are high, emphasis on growing two crops of paddy should be coordinated with a partial three crop system of rice-rice-rape, or rice-rice-broad beans. In places where the workforce carries a heavy load and where normal year yields from two crops of paddy are not high, plans should call for some growing of a single crop of paddy and a single dryland crop in the rotation of wetland and dryland crops. Lowlying paddyfields prone to waterlogging should be planted to a single crop of paddy to reduce secondary gleying.

This region has adequately high temperatures and sunlight for late rice crop production, but it also suffers from unfavorable elements such as summer and autumn drought, insect pests, and cold dew winds. If water and fertilizer are available and the growing of early and late paddy crops properly dovetailed, sturdy seedlings grown, and various technical measures correct, the greater will be the certainty of increased yields from the late paddy crop. However, in some places late crop rice yields fluctuate around 400 jin per mu simply because of the existence to varying degrees of ideas that emphasize the early crop and slight the late one. In 1975, for the first time in history Hanshou County realized a late paddy output that was greater than the early paddy output, and which was close to its total grain output for all of 1965. This shows a very great potential exists for increasing late paddy yields. The key lies in correcting perceptions, strengthening leadership, and overcoming metaphysical "low yield theories" about the late paddy crop. A vigorous attack must be mounted against weak links. One such action must be a good job of farmland capital construction and improvement in scientific management of water to improve capabilities to withstand drought. Second is the readying of a sufficient amount of manure for the late paddy crop through increased raising of hogs and accumulation of manure, plus "growing of the three water crops [water cabbage, duckweed, and water hyacinths] plus red azolla used for green manure," and increased growing of sesbania as green manure. Third is "growing of sufficient numbers of sturdy seedlings for transplanting around 23 July, and for even and close planting to get numerous panicles, regulation of manuring and watering to promote growth, and all-around preventive war against insect pests." Frequently cold dew winds hurt late crop hybrid paddy in a three crop system. In northern Hunan, every effort must be made so that the safe period for full panicle formation occurs during the first 10 days or during the early days of the second 10 days of September when average daily temperatures remain above 23°C if the empty glume rate is to be effectively controlled and consistently high yields realized.

Dryland grain production in northern Hunan has the following features: (1) A small percentage planted. The mountain and hill region has 35.8

percent of the total drylands area in the province, and the lake and plains area has 64.2 percent. In the former, mostly grain is grown; in the latter, mostly cash crops are grown. According to 1975 statistics, more than 2.7 million mu was planted to dryland grain crops for a 588 million jin gross output. This amounted to 13 percent of the area sown to grain in the region and 6.6 percent of gross output, and was 240,000 mu less than the area sown to cash crops. In 1979, 3.32 million mu was sown to dryland grain crops, for a gross output of 770 million jin, which was 16 percent of the total area sown to grain crops and 7.17 percent of gross output. (2) Ways of multiple cropping are numerous. For drylands, a two crop system holds a commanding position. Where cotton growing predominates, the two crop system is cotton and pulses (broad beans), or cotton and wheat or barley. Where growing of sweet potatoes predominates, the system is sweet potatoes and wheat or barley, or sweet potatoes and rape, or sweet potatoes and pulses. In addition grain and cotton are intercropped (or else early maturing gaoliang and corn are intercropped) or doublecropped (with sweet potatoes). Some paddyfields grow two crops of paddy and one dryland crop (wheat or barley) one after another. A small number of paddyfields also grow one crop of paddy and one winter crop. (3) Potential for increased yields is great. Yields per unit of area for dryland grain crops are currently not high, while increased harvests of dryland grain crops hold major significance for increasing overall grain output and making a greater contribution.

(2) Efforts To Increase Cotton Yields Per Unit of Area

Northern Hunan is the province's major cotton growing area. According to 1979 statistics, the area sown to cotton there was 1,541,900 mu and output was 1,364,500 dan. This was 64 percent of the area sown to cotton throughout the province, and 72.8 percent of gross output. Cotton yields for the area averaged 88 jin per mu. This was 10 jin higher than average yields per mu for the province as a whole. However, in an overall sense, such yields are still unable to meet demands in developing the national economy.

Counties in this region have the soil, water and heat conditions for the growing of cotton. Along the Liyang Plain and the lower reaches of the Yuan Shui, in particular, and all the way to the alluvial plain and low hill region on both shores of the Dongting Hu, there are vast continuous tracts of sandy clay, plus between 1,600 and 1,800 hours of sunshine every year. During the cotton growing season, the weather is clear 60 percent of the time, and during July and August the sunny day rate reaches 60 percent. During September when the cotton is in full bloom, the sky is clear for about 20 days. Usually 22 April marks the beginning of the time when average daily temperature stabilizes at 15°C, and the final day of such temperatures is 20 October, give or take a few days. The sustained period of such temperatures is thus about 180 days, and cumulative temperature is more than 4,100°C. The period when summer season temperatures in cotton growing areas average about 25°C is during the boll formation and boll ripening period between the beginning of August and the last 10 days of October, when the difference between daytime and nighttime temperatures gradually increases, and cool weather sets in, which may promote maturation. However, unfavorable meteorological factors include the following: low temperatures and rainy or

overcast weather during April and May, which affects the sowing, sprouting, and formation of full stands of cotton. Summer and autumn drought opens the cotton to the possibility of cotton buds and bolls falling off, and continuously rainy and overcast days during the ripening period may hurt cotton harvesting and quality. The proneness of the lake region to waterlogging and the fairly high water table there is an additional unfavorable factor.

Cottonfields in this region should be suitably concentrated in continuous tracts, the growing acreage stabilized, further improvements made to the drainage and irrigation system, consistently high yield cotton production bases expanded, and intensive farming done. The vigorous work done in Changde Prefecture to level cotton fields greatly changed the former situation of most of the land being level but some of it not being level, which made it impossible to get irrigation water in or to drain water out. At the same time, some commune and brigade dispersed cottonfields were readjusted and appropriately concentrated in continuous tracts, so that the so-called "high standing," "superb," and "nice looking" cotton grew in the right soil everywhere. In the lake area of Hanshou County, efforts were devoted mostly to lowering the water table, and this effort plus leveling of fields and the making of terraced fields on slopes in hill regions solved the problem of a source of irrigation water and improved the soil as well. Lixian went on from its completion of the ditch system on the Liyang Plain to leveling the land, and substantially succeeded in being able to both irrigate and drain readily. Anxiang County has a large number of ditches, streams, and lakes, and its water table is high. In building its cotton fields, it emphasized the "four changes," namely changing cotton lands to cottonfields, leveling the land and finishing work on the four ditches; changing shallow ditches with wide ridges to deep ditches with narrow ridges; changing low yield soil to fertile soil, and changing from dispersed fields to continuous tract fields. The foregoing measures produced an all-around tackling of water, manure, and soil problems, and substantially improved cotton production conditions.

Vigorous spread of advanced techniques and beginning the scientific growing of cotton: (1) First was vigorous breeding and promotion of superior varieties and a good job of cotton seed production as an important means of realizing high yields of superior quality cotton (Table 52). (2) Sowing on time and correct close planting. Around the time of the "grain rains" [20 April], when temperatures stabilize at higher than 15°C, a rush is made to sow cotton on clear days and an effort made to complete it before sowing the early rice crop so as to avoid competition between rice and cotton for labor. In addition, it is necessary to suit general methods to local situations to do close planting correctly, making sure plants are close together but rows between them are wide to improve sunlight and ventilation conditions between rows, promote full development of individual cotton plants, and make the most of the role of plant communities in increasing yields. (3) Early care to promote early development. This includes sensible fertilization and irrigation and strengthening of plant protection work. During the sprouting period when much rain falls, making sure that ditches are clear so water can pass freely is particularly important. Cultivation should be done early and well to promote development of root systems. Sources of manure should be

increased for suitable fertilization. The amount of base fertilizer should be ample, and manuring of seedlings should be light. Manuring for boll formation should be just right, and manuring for the opening of bolls should be heavy. When plants enter the stage of flowering and boll formation, they require substantial amounts of water and fertilizer. This is the time of summer drought and higher temperatures, so irrigation must be done promptly, the water used to regulate fertilization. Use of spray irrigation or drip irrigation conserves water and reduces dropping of cotton buds and bolls. Numerous diseases and insect pests infest cotton and cause damage for a long period of time. A program of "prevention first" must be carried out, with the use of multiple prevention and control measures in combination including agricultural prevention and control, biological prevention and control, chemical prevention and control, and catching of insects by people. Special efforts must be made during the "dual rush" period for prevention and control of cotton diseases and insect pests.

Table 52. Summary of Northern Hunan Superior Cotton Varieties

(a) 品种	(b) 组合	(c) 类型	(d) 皮棉亩产（斤）	(e) 生育期（天）	(f) 主要特征特性	
(g) 岱红岱	（岱字15号×一树红）×岱字15号 (h)	(i) 中熟	200 250	120	株型紧凑、棉绒长、衣分率高，纤维洁白。叶片大小适宜，吐絮畅而集中。花蕾期长势强，后劲足。	(j)
(k) 洞庭一号	岱字15号选出 (l)	(i) 中熟	200 左右 (m)	125	植株稍紧凑、耐寒、耐旱性强，适应广。衣分率高，纺织品质良好。	(n)

Key:

a. Variety
b. Combinations
c. Type
d. Yields per mu of ginned cotton (jin)
e. Growing season (days)
f. Major characteristics and properties
g. Daihongdai
h. (Daizi No 15 X Yishuhong) X Daizi No 15
i. Intermediate maturing
j. Compact plants, long fiber, high ginning outturn rate, pure white fiber. Suitable leaf size, smooth and opening of bolls during a concentrated period. Strong growth during budding stage, with reserve strength.
k. Dongting No 1
l. Selected from Daizi No 15
m. About 200
n. Somewhat compact plants; cold tolerant and strongly drought resistant; wide adaptability. High ginning outturn rate; superior quality textile products.

(3) Development of Hemp Crops

1. Ramie: Yuanjiang County in this region already has a more than 1,080 year history of growing ramie, and it is a traditional cash crop. In 1979, northern Hunan planted 65 percent of the ramie grown in the province and produced 84 percent of its output. Yuanjiang County alone sowed 35.4 percent of the area sown to ramie in the province, and produced 47.2 percent of the ramie. The Sihu and Huangmaozhou regions are foremost among the nine regions of Yuanjiang County in the growing of ramie. Every one of the 37 communes in the county has ramie farms, 21 of them sowing a 100-500 mu area; six of them sowing a 500-1,000 mu area; and two of them, Dacheng and Guangfu, sowing more than 2,000 mu. Zimucheng has grown as much as 4,485 mu. Thus, Yuanjiang County is the hub, and the ramie growing area stretches through Hanshou, Yiyang, Nanxian, and Huarong counties, and north and south through the middle of the lake region.

Ramie likes heat and moisture. Its growing period occurs when temperatures are from 11 to 32°C, and the ideal temperature range is 23-30°C, with about 1,000 millimeters of rainfall, and a relative humidity greater than 80 percent. The soil layer should be thick and fertile, and consist of sandy loam and clayey loam with good drainage and a pH of 5.5-5.6. A growing area that has both some direct sunlight and some diffused light and a slight breeze is best. Northern Hunan possesses the foregoing basic natural conditions, and the lake region is particularly favorable for the growing of ramie. However, waterlogging poses a danger for the first crop, and the second and third crops are threatened by wind damage or drought. If it fails to rain for about 50 days in a row, low yield fields will abort, and high yield fields will produce only half a crop. This is a major problem requiring serious attention in production.

When growing ramie in northern Hunan, in order to provide proper environmental conditions particular attention should be given to making ditches to drain waterlogging away promptly and to do garden style farming in order to facilitate drainage and irrigation and to improve capabilities to prevent and resist drought. Windbreak forests may be planted around fields to weaken wind velocity and to increase humidity and the amount of diffused sunlight. "Luzhuqing" ramie is fairly wind resistant, but it is not as drought resistant as "Huangkezao," which also produces three crops fairly consistently. New variety "Xiangzhu No 1" combines the virtues of both of these. Other varieties include "Bailiqing," and "Xijieba." Quality is the same for all except "Huankezao." They can be made into ramie cloth, and output of all the rest is fairly high and quality pretty good. Ramie production is strongly seasonal, and it must be cut at the right time. The first crop of the year should not stand in the fields beyond around 6 June; the second crop should grow no more than 50 days, and the third crop should be harvested before the time when the hoar frost descends [around 23 October]. When work on the early crop helps the late crop, yields will increase from all crops. Since ramie is a perennial crop, it requires a considerable amount of fertilizer, and good winter care is an important link for increased yields for the whole year.

The building of ramie bases should be done mostly in current production areas. The five central county bases should be gradually connected into a continuous tract, and production areas in other counties should likewise be centralized so as to help administration and management and increase marketable rates.

2. Jute and Ambari Hemp: The growing of jute and ambari hemp began fairly early in Nanxian and Huarong counties in this region of the province. Following liberation, production began on large tracts in the lake region. In 1979, this region planted 96 percent of the province's jute and ambari hemp and produced 99 percent of its output. Nanxian County alone planted 44 percent of the area and produced 48 percent of the output. Jute and ambari hemp production also expanded in neighboring Huarong, Anxiang, and Yuanjiang counties as well as in Hanshou, Changde, and Xiangyin counties. Thus, the central lake region is clearly the place where jute and ambari hemp production is done on continuous tracts.

Jute and ambari hemp are crops requiring short hours of sunlight. They like warmth and bud best in temperatures of 20-25°C. During the period of vegetative growth, temperatures of 25-34°C are ideal. These crops also like moisture, so irrigation during the dry season produces striking increases in yields. They are strongly tolerant of flooding and resistant to waterlogging. Their soil requirements are not strict; however, a thick, loose soil that holds water and fertilizer well is best.

Northern Hunan has environmental conditions that are outstandingly in consonance with the physiological characteristics of jute and ambari hemp. Full use should particularly be made of the sand flats in rivers and lakes for the building of marketable product bases rather than compete with cotton and grain for the use of land. Practice has shown that wherever rape and broad beans can be safely grown in winter, jute and ambari hemp can also be grown, and high yields can also be assured. Jute and ambari hemp may also be grown or transplanted to sand flats that are not inundated during April through June flooding, or to flats that are inundated during flood crest in July and August provided the current is not too swift. So long as the tops of jute and ambari plants are not submerged during inundations, their bases will be able to grow unsecured roots (water roots) that absorb oxygen and nutrients from the water. Sturdy jute and ambari seedlings higher than 1 chi may be completely submerged for 8 to 12 days without dying. The taller the plants, the stronger their ability to resist waterlogging and tolerate inundations. Consideration should be given to the following three kinds of sandbar islets in rivers and lakes for the planting of jute and ambari hemp (Table 53): Sensible planning of the crop to be planted before jute or ambari hemp must be done. The early crop should help the crops that come later for high yields from both crops. In recent years, Lixin Production Brigade in Mingshan Commune, Nanxian County has conducted experiments in the intercropping of paddy rice and jute or ambari hemp, or the cropping of paddy rice and jute or ambari hemp sequentially. They have used early ripening, high yield varieties and have improved cultivation and care techniques for bumper harvests of both grain and jute or ambari hemp.

Table 53. Suitable River and Lake Islets for Growing Jute and Ambari Hemp

(a) 适 合 程 度	(e) 高 程 (米)	(f) 生 产 利 用
(b) 适 宜 地 带	30—33	(g) 不围而垦，可与油菜蚕豆套种
(c) 较 适 宜 地 带	28—30	(h) 结合灭螺，育苗移栽
(d) 不 适 宜 地 带	<28	(i) 白泥洲、湖草、低洼积水

Key:

a. Degree of suitability
b. Suitable area
c. Fairly suitable area
d. Unsuitable area
e. Elevation (meters)
f. Production and use
g. Land reclaimed without building of embankments. May be intercropped with rape and broad beans
h. Need to kill snails, and propagate seedlings for transplanting
i. Whitish soil sandbar islets, lake grass, and lowlying stagnant water

(4) Active Farming of Silkworm Mulberry

This region has a long history of growing silkworm mulberry, and it is one of the province's three old silkworm areas (the lakeshore, Hengyou, and western Hunan). It also produces the most. Because of poor planning of production since liberation, the growing of silkworm mulberry has not kept pace with developments. In 1959, this region produced 57 percent of all the province's cocoons, Lixian, Changde, Huarong, Anxiang, and Nanxian counties producing 43 percent of the region's total. In 1971, this region produced 82 percent of the province's total silkworm cocoon output from 43,000 mu of mulberry groves or more than 25,000 fewer mu than in 1959. In 1975, 24,300 mu of mulberry groves produced 6,171 dan of cocoons. This was 34.5 percent of the province's mulberry growing area and 54 percent of its cocoon output. In 1979, the region had 31.3 percent of the province's mulberry grove area and 44 percent of its cocoon output. Today the province has 20 silk mills in Jinshi, Yiyang, Nanxian, Changsha, Xiangtan, Beisheng in Liuyang, and in Hongjiang. One plant in Jinshi alone requires 30,000 dan of silkworm cocoons annually, and raw materials are far from able to satisfy needs.

Numerous advantages result from expansion of silkworm mulberry production as follows: (1) Sideline occupation avenues are widened; collective earnings increased, and the country's needs satisfied. In 1975, Songshi Commune in Huarong County built a cocoon farm at Bawei. During the following year, earnings from the cocoon industry alone accounted for 60 percent of total earnings from agricultural sideline occupations. The Maotian district of Yueyang County built mulberry groves in the mountainlands from which Changcang Brigade had diversified earnings from cocoon and medicinal herb production in 1975 amounting to 43 percent of gross income from agricultural sideline occupations. (2) Silkworm dung is a quick acting fertilizer of

superb quality. Scientific testing has shown it to contain again as much nitrogen as hog manure and a substantial amount of potassium. Dead silkworms can be sun dried, pulverized and fed to hogs. Silkworm dung can also be fed to fish fry. Not only can the growing of mulberry provide leaves to grow silkworms, but the trees can also break waves to protect dikes, and mulberry wood makes superior lumber for farm implements. Mulberry branches pruned in spring may be used for firewood, and mulberry bark may be used to make paper.

This region has many outstanding conditions for growing silkworm mulberry as follows: (1) It has a large amount of soil resources, and plenty of water and manure is available. Sandbar islets, river flats, unused dikes, irrigation canals and streams have spacious land for the planting of mulberry. Furthermore the soil layer is thick and fertile in these places; the soil is usually mildly alkaline or neutral, and within 3 to 5 years after seedlings have been planted, a forest develops. Climate is temperate, making possible the raising of five crops of silkworms each year (one each in spring and summer, and three in the fall). Because of the cold air circulation and fairly great wetness during the spring cocoon season, special care must be given. During fall, temperatures are high, mulberry leaves are old, numerous diseases and insect pests are prevalent, and the workforce is very busy. In addition, cold dew winds tend to come early, so careful care must be given and sensible plans made for growing silkworms at this time. (2) The masses have abundant experience in the raising of silkworms and the growing of mulberry, and they have gradually turned local silkworm species into superior silkworm species; have switched from natural warmth to artificially controlled warmth, and have gone from scattered and decentralized growing of silkworms to centralized operations. (3) As agricultural modernization increases, workforces can be freed for sideline occupation production such as silkworm mulberry.

In order to meet needs in developing large-scale socialist agriculture, and to make the building of mulberry groves a part of farmland capital construction plans and in the category of a commune and brigade enterprise, as of the end of 1979 Huarong County had a 9,186 mu mulberry grove area. Collective planting of mulberry and raising of silkworms increased from the two production teams of 1972 to 85 units in 1979, with Panjia, Jinggang, Xinhe, and Longxi communes having model experiences in the building of silkworm mulberry farms.

Active ways in which to consolidate and develop northern Hunan's silkworm mulberry production are as follows: (1) A rational pattern of distribution and the building of bases. Existing silkworm mulberry bases should be further consolidated and enlarged, with new mulberry groves using unused land in the "four besides" as well as river flats and sandbar islets to the maximum extent possible. A combination of poriferal areas and bases, and a combination of centralization and decentralization should be used. Places having requisite conditions may operate commune and brigade silkworm mulberry farms as appropriate, build mulberry grove bases that can be both irrigated and drained, and engage in specialized production. (2) Reliance on the masses and building of farms through self-reliance. The lake region

labor force carries a rather heavy burden, and lacks bamboo timber. As a result, it should organize production in an equitable way, improve administration and management, practice distribution in accordance with work, and do a good job of grain supply work. It should set aside a certain area for the growing of bamboo timber. Its silkworm sheds may be rudimentary; it can make its own tools; and it can train its own specialized technical forces through actual practice, using a combination of a specialized corps and the masses to promote development of silkworm mulberry production.
(3) Strict attention to the task of planting and propagating seedlings to upgrade the scientific raising of silkworms. It should set up bases to propagate seedlings and breed superior seedlings, using local resources to assist development of new areas. Silkworm species are an important means of production, and a good job should be done at the province's Hejiashan stock farm's silkworm specie station and in building silkworm specie farms in Changde and Hanshou counties. It is necessary to put an end to low yields of autumn cocoons by increasing the raising of early autumn silkworms, growing sufficient numbers of mid-autumn silkworms, and sufficient mulberry leaves to raise late autumn silkworms so that the output of autumn silkworms is larger than that of spring silkworms.

(5) Steady Development of Sugar Crop Production

The growing of sugarcane poses very high demands for heat, moisture, and soil fertility. Practice has shown that since the lake region in northern Hunan possesses favorable natural conditions to a considerable degree, not only can the region grow sugarcane, but it can produce high yields of sugarcane with a high sugar content as well. State farms such as the Datong Hu Farm, the Xi Dongting Farm, and the Jinpen Farm have increased the sugar content of their cane and increased sugar yields over the years through the spread of superior sugarcane varieties. During the 1977-1978 crushing year, the Datong Hu Farm produced 2,338 tons of sugar for a 9.54 percent sugar output rate with sugarcane being crushed having an 11.65 percent sugar content. The sugar output rate for Xi Dongting Farm's sugar refinery was 10.6 percent, and the sugar output rate for the Jinpen Farm's sugar refinery was 9.26 percent.

Since 1972, the lake region has set up 10 medium size and small mechanized sugar refineries that are daily able to process 4,500 tons of sugarcane. Sugar refineries have not been able to get sufficient cane in recent years because an insufficiently large area has been planted to it, so the utilization rate for equipment is low. Were the 10 sugar refineries able to operate at designed capacity, with 6,000 mu of sugarcane grown for those capable of processing 200 tons daily, 12,000 mu grown for those capable of processing 400 tons daily, and 15,000 mu grown for those capable of processing 500 tons daily, and were superior varieties promoted to increase yields per mu, each providing about 3 tons of raw sugarcane with an 11 to 12 percent sugar content and a better than 8 percent sugar output rate, the 10 sugar refineries would produce more than 30,000 tons of cane sugar annually.

The crux of good performance in sugar production in the lake region of northern Hunan lies in the building of sugar crop production bases with

consistently high yields all around the sugar refineries. Not only should this plan be made a part of overall plans for farmland capital construction, but it should be treated as a major ingredient in economic diversification.

(6) Vigorous Increase in Aquatic Products

Northern Hunan's rivers and lakes cover a wide area and produce prodigious quantities of fish, lotus, and natural fish fry. Historically this region has been a fishing and farming center, and it has gradually developed an aquatic products breeding industry. It is a major base for marketable aquatic products in the province that combines rearing, catching, and farming.

1. The Fish Catching Industry. This region's fishing industry catches most of its fish in the lakes, and particularly in the eastern and southern Dongting Hu and connecting rivers. Natural fish food is abundant here, and the lakes provide a superior environment for the fattening and breeding of some of the economic fish species found in the Chang Jiang. Reserves of natural fish species depend largely on hydrological changes. Rivers annually carry about 400 billion cubic meters of water into the lakes, and this volume of water comes from various precipitation areas. Flooding of the basins of the four rivers occurs mostly between April and June; the Chang Jiang floods mostly during July and August. Maximum depth of water in the lake basin during high water season is around 15 meters, but averages 5 to 7 meters. Minimum depth is around 2 meters. The ratio of water volume during flood stage (June to August) versus the low water stage (December to March) is 8:1. Changes in the water situation affect the fishes' habitat, and their migration. This produces different fishing grounds and fishing seasons. Catches during the year may be roughly divided into those made during spring high water (March to May), those made during high water (June to August), those made during the drop in water (September to November), and those made in winter (December until February the following year). It is virtually a law in the region's natural fishing industry that much water brings numerous fish.

Silting and reclamation of farmland from the lake over the years, and the gradually shrinking of the lake area and volume have meant a shortening of the fishing season. This plus the building of water conservancy projects, industrial pollution, and use of damaging fishing gear and fishing methods has led to a decline in natural fish resources with the result that catches have declined like a plunging wave. For example, during the period immediately following liberation, fish catches for Yueyang Prefecture averaged around 200,000 dan, but stood at about 100,000 dan in each year after the 1960's. During the period immediately following liberation 70 percent of fish output derived from catches, but during the 1960's it went from 60 to 40 percent, and during the past several years, it has declined to about 30 percent. An average more than 70 percent of fish purchased at Chengguan in Yueyang is of grades 3 to 6, which shows that fishing industry catches today are supplements to the main source of supply.

In order to make equitable use of and increase the breeding of fish resources, and to develop fishing industry production, the following is suggested to transform and build the fishing industry: (1) Deciding the kinds of fishing gear to be used, size of catches, scale of operations, and intensity of fishing in various fishing grounds on the basis of current fishing ground operating capacity, and changes in fishing industry capabilities and resources. As regards fishing gear that currently damages fish resources, the size of net openings should be increased and improvements made in organizational and operating methods, the scale of operations being controlled. Fishing gear and fishing methods that cause serious damage to resources such as burlap nets, traps, mahao [7802 4761 3032], and cailiu [6425 6448] should be controlled quickly and gradually abolished. Use of poison, explosives, or electricity, which torture fish, should be strictly prohibited. (2) Intensivity of fishing should be strictly controlled in major routes used for spawning, feeding, overwintering and migration (places such as the area between Junshankou and Chenglingji), and arbitrary reclamation of water areas for use as farmland, building of dams, dragging of nets, or scraping with hao [4761 3082] should not be permitted. (3) The presently existing major economic fish concentrated spawning grounds such as Dawan, Xiaowan and Junshanhou Hu of eastern Dongting Hu, the southeastern tip of southern Dongting Hu, Baota to Dawan of Wanzi Hu, as well as the area from an imaginary line passing through Sangangzi to Hekouzi to Erba on Lu Hu, and the northern depression of western Dongting Hu should be more closely protected. At the same time, prefectures and counties should increase or regulate prohibited fishing areas as changes in fishing grounds dictate. They should also rule the period from around 5 April to 21 May to be a no fishing period. Artificial breeding of fish fry should be vigorously advocated, and controls should be instituted to curb the taking of natural fish fry to increase the breeding of natural resources. (4) In the current killing of snails, building of low embankments and construction of bases to produce reeds, concurrent attention should be given to protection of the breeding of aquatic product resources and to keeping canals and streams open so that young fry can return to lakes. In the killing of snails and reclamation of water surfaces, arbitrary opening of dikes or sluice gates to release water and catch fish is not to be allowed. (5) Toxic waste water from industries must be cleaned up and not just discharged untreated into rivers.

2. The Fish Rearing Industry. This region's fishing industry production requires both active protection and increased breeding of natural resources and a rational restructuring of that part of the fishing industry that makes catches, as well as vigorous efforts to develop the breeding of fish in lakes, ponds, and reservoirs. In addition to rivers and lakes that flow out of the province, there is presently 2.5 million mu of water surfaces that can be used within the province from the lake plain to the hill and mountain region. As of 1979, 1.75 million mu, or 70 percent of this water surface was being used for the rearing of aquatic products, and the quantity of aquatic products reared accounted for 65.5 percent of the region's total output of aquatic products. (Table 54) Clearly, for further development of the breeding industry a combination of rearing and catching of fish is an important way in which to realize consistent increases in output of the fishing industry. This is particularly true in the lake plains region where inland lakes

provide more than 1.7 million mu of water surfaces, and where state-owned fish farms and commune-operated fish farms are in the process of active development. Donghu Fish Farm in Xiangyin County has adopted a program of "taking the rearing of fish as the key link in multiple kinds of operations," producing 4,723 dan of fresh fish in 1975. This was 1.3 times its 1965 output. It also increased considerably its output of hogs and grain for an average per capita output value of 7,800 yuan. The whole farm showed a profit of 90,000 yuan in demonstration of the model role of the state-owned fishery farm. The Wanhe Commune Fishery Farm in the same county adhered to a program of self-reliance and toiled for 17 years at operating the farm. Today, 1,000 mu of open lake on the farm produces yields of 75 jin per mu of fish. The rearing of fish in mountain ponds at Zhongnan Commune in Huarong County produces yields of 270 jin per mu. From 45 mu of experimental ponds at the commune, maximum yields have amounted to 1,012 jin per mu. Nieshi Commune in Linxiang County has also made gladdening accomplishments from the use of reservoirs to rear fish.

Table 54. Northern Hunan Aquatic Products Output in 1975

(a) 地区	(f) 放养水面（万亩）					(l) 鱼种池 寄养池（万亩）	(m) 水产品产量（万担）				(q) 湘莲	
	(g) 合计	(h) 池塘	(i) 湖泊	(j) 水库	(k) 其他		(g) 合计	(n) 捕捞	(o) 养殖	(p) 其中：鱼类	(r) 面积（万亩）	(s) 产量（万担）
(b) 共计	174.26	42.34	100.49	29.4	2.03	3.94	90.39	31.06	59.33	84.53	11.83	3.21
(c) 岳阳	56.66	12.0	37.0	7.66	—	1.25	31.42	11.41	20.01	26.92	3.14	0.75
(d) 益阳	46.42	10.95	33.84	1.42	0.21	1.33	26.79	11.89	14.9	26.03	4.02	1.20
(e) 常德	71.18	19.39	29.65	20.32	1.82	1.36	32.18	7.76	24.42	31.58	4.67	1.26

Note: Yueyang, Yiyang, and Changde prefectures include 14 counties and provincial farms.

Key:

a. Region
b. Total
c. Yueyang
d. Yiyang
e. Changde
f. Surfaces used for fish rearing (10,000 mu)
g. Sub-total
h. Ponds
i. Lakes
j. Reservoirs
k. Other bodies of water
l. Fish breeding ponds and rearing ponds (10,000 mu)
m. Aquatic products output (10,000 dan)
n. Catches
o. Rearing
p. Including fish
q. Hunan lotus
r. Area (10,000 mu)
s. Output (10,000 dan)

Increasing use is being made of lakes and reservoirs in the rearing of fish nowadays; nevertheless, the actual utilization rate is still not high; yields per unit of area are low, and the rate of increase is not great. At many commune-operated fish farms, the breeding bases, equipment for penning up fish, bases for the production of fish food, and intensive use of water surfaces are not all they should be. Quantities of fish fry produced are small; standards are low; there is a lack of diversity in

varieties, and the amount of fish food is inadequate. In inland lakes, large numbers of fish are reared and kept instead of being used for stocking other waters, or else only catching is done with no rearing of fish at all. Some places have taken no account of the characteristics of different lakes and of environmental conditions; they should adapt general methods to specific lake conditions and adopt corresponding rearing methods to increase yields.

In the future a program that provides for a combination of rearing and catching, with rearing being the key link, adaptation of general methods to specific circumstances, and diversification must continue to be adhered to, with active expansion of the rearing area and the linking of full use of naturally available fish food and fish food provided by man for energetic increase in yields per unit of area and increase in gross output. (1) Most of the inland lakes in this region are old silted lakes that are closely linked to large tracts of farmlands and require rational planning. Generally speaking, the flow of nitrate water into lakes where depth of water is maintained at around 2 meters provides abundant nutrients for the rearing of fish. Such lakes may be used primarily for the rearing of fish in a combination of fish rearing, impounding of water, and irrigation so that the lakes are used to the maximum extent possible, and their vitality is increased. In addition to making fullest use of natural foods, perennial rye, Sudan grass and aquatic plants may be grown in the building of needed fish food bases. (2) When rearing fish in lakes, attention must be given at the start to getting rid of vicious fish breeds such as minnow fish, qiaobai [5062 7403] and Mandarin fish, with fishing all year long done to rid waters of such pests. In addition, care must be taken to prevent escape of fish being reared. While allowing free flow of water and maintaining transportation, suitable facilities for keeping fish in must be built that are suited to the lake topography, the nature of lake bottoms, and the kinds of fish being used to stock the lake. Fish used to stock lakes should be large, usually larger than 5 cun long. It is necessary to set up necessary fish fry breeding ponds, and fish breeding bases should generally take up 15 to 20 percent of the water surface used for fish rearing. Wide use should be made of branches from lakes, small dammed ponds, canals and streams, lotus lakes, and paddyfields for natural reproduction and rearing of fingerlings, and catching of a proper amount of fingerlings should be done. Depending on the density of lake plants, thickness of silt, and depth of water, various numbers of operations, year-round operations, and catching of large fish while reserving the small ones can be done to increase the number of fish taken rate. In large inland lakes where the water surface is vast and there are numerous branch streams, and where operations are conducted over a wide area, emphasis should be on impounding water and conservation linked to irrigation from rivers, removal of fry and artificial stocking of streams. (3) Rearing in mountain and hill ponds and reservoirs linked to farmland capital construction, increasing the impounding of water, and regulation of water sources. We must deepen shallow ponds, plug holes to conserve water, and promote the artificial breeding of numerous species of fish fry in an effort to achieve self-sufficiency in fingerlings, plus use various means to solve the problem of food for the rearing of fish. (4) Economic diversification and development of ponds for multiple uses,

with emphasis on rearing fish. The Donghe Fish Farm in Xiangyin County did various kinds of farming. Though it centered its activities around the fishing industry, it also grew paddy rice, hogs, and operated industrial plants. It used distillers' grain from its distillery and calcium phytic acid waste to feed hogs, accumulated manure and sludge from the raising of hogs to fertilize the fields and brought about a fine situation of fat hogs, healthy fish, and delicious grain.

3. Growing Hunan Lotus. This region has a substantial amount of shallow lakes, lowlying areas, lake branches, and shuaimu [3943 3965], and the masses here are accustomed to and experienced in growing Hunan lotus. Lotus lakes and lotus fields are spread throughout the lake regions of Hanshou, Huarong, Changde, Anxiang, Yiyang, Yuanjiang, Nanxian, Yueyang, and Xiangyin counties, and they account for about 60 percent of the province's total lotus output. However the growing area is not as consistent as it should be, and frequently floods, insect pests, or winds cause a certain amount of damage. In order to meet needs of Chinese and foreign markets, the growing of Hunan lotus should be made a part of plans for farmland capital construction. Paddyfields, lotus fields, and lotus lakes should be kept separate, and complete drainage and irrigation systems built, with water level controlled at various heights around the lake. Operations should be specialized; wild and mongrelized varieties should be eliminated; species should be purified; and insect pests and diseases should be prevented and controlled. Breeding and care should be intensified, harvesting should be done promptly, and consistently high yields should gradually be made a reality. Pufeng Commune in Yuanjiang County is located right in the center of the Tong Hu reclamation area. The commune operated a farm to develop multiple operations on Lusi Hu at Sanzhan, principally the growing of lotus and the rearing of fish. In handling drainage and the relationship between drainage and storage of water, irrigation and release of water, it drained water into the lake during winter and released it in spring to irrigate the fields so that both the fields and the lake had plenty of water during dry weather, regulating the use of water for farmland and for the growing of lotus and the rearing of fish. Then when the fish and lotus growing seasons changed, it changed the water depth in order to catch large fish and release small ones for a solution to the conflict that results from trying to rear fish and grow lotus at the same time. This made for bumper harvests of both fish and lotus.

Third Section. Several Major Ways To Develop Agriculture

The northern part of Hunan has a relatively large number of favorable conditions and a very great potential for development of agriculture. A prominent problem at the present time is that water conservancy in the Dongting Hu region has not yet been brought up to standards. Varying degrees of flood and waterlogging disasters occur every year, and agricultural production is not sufficiently consistent. Furthermore, the level of agricultural mechanization is not high. Large areas are not machine plowed, machine planted, or machine harvested, and there is a fairly serious shortage of manpower and animal power. Production costs are high in some counties, communes and production brigades, and a situation exists in which output increases with no commensurate increase in earnings. Thus, further improvements in water conservancy and fertilizer are required in this region, plus development of garden style farming, acceleration of mechanization, and development of the land's potential for increased yields.

1. Comprehensive Control of Rivers and Lakes, and Further Building of Consistently High Yield Farmland

(1) Main Attack on Damage From Flooding, Waterlogging, and Water Stagnation in the Dongting Hu Region

As a result of development of water conservancy construction endeavors, the area guaranteed to produce a harvest despite drought or waterlogging has gradually increased, and ability to withstand disasters has improved. However, flooding, waterlogging and drought remain one of the main reasons for the lack of consistency in agricultural production. Since liberation, the serious flooding, water stagnation and drought disasters of 1954, 1961, and 1969 occasioned serious reductions in output. In 1971, grain output was 8.2 billion jin, but as a result of flooding and waterlogging disasters in 1973, output dropped to 7.8 billion jin. In 1974, output rose to 9 billion jin and reached 10.7 billion jin in 1979. Agricultural production rose and fell in a saddle shape and climbed in a spiral.

Dongting Hu and the Jingbei Plain are an integral part of the ancient Yunmeng Marsh. In 1524, the north bank of the Jinsai breached giving rise to the Jin Jiang great embankment and the Jingbei Plain. In 1860, the lotus ponds breached their dikes, and in 1873, the Songzi flood channel punched through. This resulted in an intensification of the flooding and silting of the Dongting Hu. What was formerly known as the "800 li Dongting" has gradually shrunk. Today an average of 132 million cubic meters of silt enters the lake annually, 109 million cubic meters or 82.6 percent of it from the three mouths of the Chang Jiang. (Formerly there were four mouths, but Tiaoxiankou has become blocked.) From the four rivers comes another 23 million cubic meters or 17.4 percent. The 35 million cubic meters annually carried out of the lake at Chengji in the Yueyang county seat amounts to only 26.8 percent of the total volume of silt in the lake, an average 96 million cubic meters or 73.2 percent of the total volume of silt that enters the lake each year remains in the lake. The lake basin silts an average 4 centimeters each year, and the lake area steadily shrinks. The western

Dongting Hu is rapidly approaching the point where it will be completely silted flat; the southern Dongting Hu is moving southward, and the eastern Dongting Hu is tending to corrode eastward. In 1825, the natural lake covered 6,000 square kilometers. By 1949, this had declined to 4,350 square kilometers, and today only 2,740-odd kilometers remain. The volume of the lake has declined from 29.3 billion cubic meters in 1949 to 17.8 billion cubic meters now, retreating to second place among the country's five large freshwater lakes. (Figure 30) During the past 10-odd years, the lake area has annually added more than 60,000 mu of sandbar islets. Some natural lakes are on the verge of disappearing, and some rivers have become hanging rivers. The volume of flow of the Chang Jiang into the lake has declined from 40,070 cubic meters in 1931 to 21,300 cubic meters per second, and has declined by 7,300 cubic meters per second since liberation. All this shows that the natural lake surface of Dongting Hu and the volume of flow of rivers into the lake has become steadily less. During most flood years, the water level of the lake region rises markedly, and the period of fighting high waters has become longer. If matters take their natural course, the channels leading into the lakes and the natural lakes will very quickly lose their ability to regulate flood waters and gradually become extinct. This is not only bad for the lake region, but will also cause serious difficulties for the Chang Jiang in draining away particularly heavy flood waters.

I. Major Current Problems

(1) Flood Prevention: Preliminary statistics as of the end of 1976 show more than 2,761 kilometers of flood prevention dikes in the lakes region (exclusive of the embankments along both shores of the lower reaches of main streams in the area), 44 percent of them built to the standard of withstanding a flood such as occurs once every 20 years, and 56 percent of them not meeting this standard. But branching out of floodwaters from the Chang Jiang frequently poses a serious burden and threat for the lake region. There are 985 kilometers of flood prevention dikes, plus 8,460 kilometers of waterlogging dikes to guard against high water and main connecting dikes, or an average of almost 2 meters per capita of dikes, or about 5 meters per capita of the workforce. The high water period (May-October), a hectic time in guarding against floods, is also a rush period when harvesting and replanting must be done. This adds to the hectic situation and hurts production. According to statistics from Nanxian, Huarong, and Anxiang counties, which bear the brunt of flooding from the three mouths of the Chang Jiang, annually an average of 20 or 30 people out of every 100 work on the dike. This is about 30 percent of the people used in production, and expenses for repair of dikes amount to between 3 and 4 yuan per mu, which is more than 20 percent of total expenditures for production. Cave-ins of the 136 kilometers of high dikes along the Chang Jiang are fairly serious, and state investment in dumping stones to protect the shores is very great (Table 55).

Table 55. Collation of Basic Situation of Dikes at Various Places in the Dongting Hu Region (December 1976)

		(a) 垸 名	(b) 总 计	(c) 常德地区	(d) 益阳地区	(e) 岳阳地区
(f)		总 面 积 (亩)	14,093.878	5,336,026	4,136.982	4,620,870
(g)	耕地面积	(h) 合 计 (亩)	8,088,868	2,857,753	2,325,037	2,876,078
		(i) 其中：水 田 (亩)	5,153,689	1,867,704	1,712,548	1,573,337
		(j) 旱 土 (亩)	2,076,206	734,567	414,560	887,479
		(k) 自留地 (亩)	374,037	106,851	105,653	161,551
		(l) 甩 亩 (亩)	343,597	182,731	63,294	97.572
(m)		内 湖 面 积 (亩)	1,701,193	744,583	420,047	536,563
(n)		总 人 口 (人)	4,363,887	2,008,338	1,435,405	920,144
(o)		其 中：农业人口 (人)	4,237,170	1,744,979	1,327,318	1,164,873
(p)	防洪大堤	(q) 总 长 (米)	2,761,098	984,637	822,775	953,686
		(r) 其 中：湖 堤 长 (米)	583,731	95,637	178,664	309,430
		达到20年一遇标准 (s) (米)	1,217,619	409,301	333,310	475,008
		未达20年一遇标准 (t) (米)	1,543,479	575,336	489,465	478,678
		其中堤顶低于20年一遇水位(米) (u)	—	—	—	—
		未达到标准尚欠土方 (万立米) (v)	7,562	3,156	2,117	2,290

Key:

a. Name of dike
b. Total
c. Changde Prefecture
d. Yiyang Prefecture
e. Yueyang Prefecture
f. Gross area (mu)
g. Cultivated land area
h. Total (mu)
i. Including: Wetlands (mu)
j. Drylands (mu)
k. Private plots (mu)
l. Shuaimu (mu)
m. Inland lake area (mu)
n. Total population (persons)
o. Including: Agricultural population (persons)
p. Large flood prevention dikes
q. Total length (meters)
r. Including: Lake dike length (meters)
s. Meeting standards for floods occurring once every 20 years (meters)
t. Not meeting standards for floods occurring once every 20 years (meters)
u. Including those the tops of the dikes of which are lower than water levels encountered once every 20 years (meters)
v. Not meeting standards and requiring further earthwork (10,000 cubic meters)

(2) Draining of Waterlogging: The inland lake area has shrunk over the years in consequence of the silting of rivers and lakes. Of the 3.4 million mu area of the period immediately following liberation, only 1.5 million mu remained in 1979 (including 100,000 mu built to rear pond fish) accounting for about 9 percent of the total embankment area. The lakes' capacity to regulate the impounding of water has steadily weakened. Some dikes have become "old dikes with low fields," from which gravity draining of water is impossible. Most of the water drainage sluice gates have been rendered ineffective by the raising of the beds of rivers and lakes and the increased water level during low water stage. The increased height to which electro-mechanical drainage sites must lift water has meant a great decline in the efficiency of electro-mechanical drainage of water. As a result, calamities caused by stagnant water continue to be serious and hurt agricultural production. During the 26-year period between 1949 and 1974, except for 1967, 1968, and 1972 when there were virtually no disasters from water stagnation, an average of more than 700,000 mu was disaster stricken in every other year. For example, the 13-16 June 1977 rainfall brought water stagnation to 3.35 million mu in the lake area and caused disaster for 1.1 million mu. Calculations made on the basis of the stagnant water area show guaranteed harvests as difficult from 40 percent of the area.

(3) Fighting Drought: Since water is available for irrigation in the lake region and on the plain around the lake, and since the paddy rice ripens fairly early, in most drought years rescue efforts save the crop from any serious reduction in output. This does not mean, however, that there is no need to strengthen antidrought facilities. For example, in some places silting has rendered sluice gates and water conduits ineffective or semi-ineffective, and drainage and irrigation systems are not completely equipped. In some lake spurs, fields cannot be irrigated when water is low.

In downland and hill regions around the lakes, some streams stop flowing during summer and fall when no rains fall. Some projects have not been fully equipped; reservoirs are not filled with water; and management and use of water is not done effectively. As a result, the area from which a crop may be harvested despite drought or waterlogging averages less than 60 percent.

(4) Navigation: The lake region has always been an area of easy water transportation, but silting has halted or impeded navigation along numerous routes. Hanshou was once a port of call, but silting has turned it into a dead port. In Nanxian, the Tuo Jiang can be navigated only 3 months of the year. During the low water season, not only is navigation done via a round about way on the Changjin to Changchang route, but lightering must be done several times along the way as well. It is impossible to sail along main lines from inner lakes and inner harbors to outward rivers. This has hurt transportation and increased production costs.

II. Water Conservancy Construction Plans and Measures

Plans and Measures for Control of the Dongting Hu Region

Short-term plans to control the lakes center around dredging and clearing flood channels for gradual elimination of chaos in the water system,

shortening flood protection dikes, and reducing the damage caused by silting. Efforts are to continue to increase the height of dikes and to strengthen them, to remove hidden dangers, and to improve ability to withstand floods; to do a good job of building for safe impounding of floodwaters, to impede the flow of mountain torrents, and to make contour catchments. Continued building and equipping of electrically powered drainage and irrigation is to receive serious attention to improve flood prevention, drainage and irrigation, and to control the lake and regulate the impounding of water. The ditch system is to be completely equipped, and work is to be done over a period of time to dig out the lake, raise the fields, and build garden style farming.

Blocking stream branches and merging flow in the lake region. Experience throughout history has shown it possible to control waters and attack silting to reduce the uncontrolled accumulation of silt. Increase in the volume of water currently discharged from the Jing Jiang has also created the objective conditions for controlling the flood channels from the three mouths of the Chang Jiang. This will not only help development of Dongting Hu, but can also preserve the rivers and lakes effectively and increase the capacity of the Chang Jiang to swallow up and disgorge flood waters.

1. Flood Prevention and Impounding of Flood Waters

Flood prevention requires, first of all, the dredging of flood channels, particularly in the southern Dongting Hu but also in the flood channels of the Li Shui and the Yuan Shui. There must be planned widening and deepening of main flood channels, directing of waters back into troughs, deep scouring of river beds, and expansion of the amount of water discharged. Plans call for blocking 10 branch channels that have become silted and shortening the length of flood prevention dikes from the current 2,761 kilometers to 580 kilometers (Table 56), and a reduction to 218 kilometers. At the same time, dikes are to be increased in height and strengthened so they will be able to withstand floods such as occur only once every 20 years. In order to withstand exceedingly high storm waves, the height of river and lake dikes is to be increased 1.5 and 2 meters respectively.

Impounding of flood waters: Readjustment of the flood water impounding zone to four areas. In the event of a recurrence of a flood like the one of 1954 when flood diversions suddenly breached dikes, the impounding of flood waters will be required. (Table 57)

Building safety platforms along the large dikes in each floodwater impounding area to serve as permanent installations. In areas where population is fairly concentrated, safety zones may be made behind embankments for use both as temporary refuge sites equipped with safety boats, and for the provision of other protective facilities.

Table 56. Statistics on Plans To Shorten Dikes in Lakes Region

	河名 (a)	河长（公里）(b)	缩短堤线（公里）(c)
(d)	松滋东支	43	86
(e)	书院洲河	9	18
(f)	沱江	39.2	284
(g)	陈家岭河	20.4	
(h)	安乡河	45.3	
(i)	鲇鱼须河	24.7	
(j)	甘溪港	20.0	
(k)	湘水西支	29.0	192
(l)	资水东支	35.0	
(m)	合计	265.6	580

Key:

a. Name of river
b. Length of river (kilometers)
c. Dike shortening (kilometers)
d. Eastern branch of the Songzi
e. Shuyuanzhou He
f. Tuo Jiang
g. Chenjialing He
h. Anxiang He
i. Zhanyuxu He
j. Ganxi Gang
k. Western branch of the Xiang Shui
l. Eastern branch of the Zi Shui
m. Total

Table 57. Planned Dikes for the Impounding of Floodwaters in the Dongting Hu Region

	蓄洪区 (a)	总面积（平方公里）(b)	耕地面积（万亩）(c)	人口（万人）(d)	现有防洪堤长（公里）(e)	有效容积（亿立米）(f)	备注 (g)	
(h)	大通湖	1693	120	61.5	202.5	101	包括漉湖	(m)
(i)	横岭湖	546.6	24.3	15.6	136.2	36.1	包括城西、湘滨南湖	(n)
(j)	钱粮湖	299	22.5	9.66	41.2	17.5	包括新生大垸	(o)
(k)	汨罗江	181.7	15.9	5.8	37.8	12.8		
(l)	合计	2720.3	182.7	92.56	417.7	167.4		

Key:

a. Floodwater impounding area
b. Total area (square kilometers)
c. Cultivated land area (10,000 mu)
d. Population (10,000 persons)
e. Length of existing flood prevention dikes (kilometers)
f. Effective capacity (100 million cubic meters)
g. Remarks
h. Datong Hu
i. Hengling Hu
j. Qianliang Hu
k. Miluo Jiang
l. Total
m. Including Lu Hu
n. Including Chengxi and Xiangbinnan Hu
o. Including the Xinsheng Great Dike

Chang Jiang Bank Revetments: As a result of scouring by the current, serious collapses occur in the embankments along the Chang Jiang in northern Hunan, threatening the safety of farmlands and inhabitants along the shore. The dike along the lower Jing Jiang between Shijiayuan and Louxiwan is 75 kilometers long, and 34.4 percent of this length is a cave-in area. The dike of the Xiang Jiang from Chenglingji to Tieshanzui is 64.84 kilometers long, and 23 percent of this length caves in at eight separate places. A total length of 23.3 kilometers requires guarding, and plans call for 3.16 million cubic meters of earthworks to protect 522,000 mu of cultivated land. The main area to be protected is 8 kilometers at Jingjiangmen where there is about 300,000 mu of cultivated land. This is an organic integral part of plans for guarding the entire lake region against floods.

2. Draining of Waterlogging and Irrigation

The waterlogging disasters of the lake region are inseparable from the silting of the lakes. Solution to the problems cannot be found through unlimited expansion of the inland lake area, nor in excessive demands to increase drainage using electrical means. It must depend mostly on building garden style farming, digging some deep ditches and large canals, linking inland lake drainage and irrigation systems, keeping flood channels open, draining away stagnant water, lowering the water table, plus adopting different measures commensurate with different terrain and soil characteristics. For example, in Anxiang, Huarong, Yuanjiang and Nanxian the soil has a larger sand content, and fields must have open drains so water can be drained off. Moreover both open and covered ditches must be dug in other heavy clayey soils in order to drain water away. In semi-hill, semi-lake regions, water comes from over a wide area, so digging ditches to carry away floodwaters is most important. Where the ground is relatively low-lying, deep inner lake ditches and streams must be dug and dikes to prevent water stagnation must be made higher and strengthened to make the water level rise in inland lake ditches and streams and increase opportunities for gravity drainage of water through sluice gates. In low-lying areas electric drainage facilities must be suitably increased. Regarding the presently existing lakes, we must dredge the lakes and raise fields, and reinforce floodland. In this way we can increase the storage capacity of the lakes and also transform low-lying land and develop production. The 265.6 kilometers of floodwater channels of the eastern branch of the Songzi, Shuyuan Zhou, the Anxiang He, the Tuo Jiang, the Chenjia Ling, the Zhanyuxu He, the Ganxi Gang, the western branch of the Xiang Shui, and the eastern branch of the Zi Shui may be raised up to serve as main channels for the gravity draining of waterlogging or for use as plains reservoirs to develop gravity irrigation.

In the hill regions around the lakes, more projects to divert flooding should be built. The area from which water enters semi-hill and semi-lake regions is vast, and the rainy season increases disasters caused by waterlogging and stagnant water in lakeshore areas. In order to divert mountain torrents, the one diversion and two channeling method was used on the north shore of the Cen Shui, on western Maoli Hu, Chongtian Hu, Nan Hu, Lanni Hu, Ye Hu, Huanggai Hu, and on Dajing Hu. Canals to divert flood waters were opened wide, and interior lake dikes to prevent water stagnation were increased in height and strengthened for the diversion of water from mountain regions

over a 4,912 square kilometer area, to protect 2,449,000 mu of cultivated land, and to increase cultivated land by 332,000 mu. Very great achievements have been made from flood water diversion projects at Chongliu Hu in Changde, at Nan Hu in Hanshou, at Ye Hu in Linxiang, and at Lanni Hu, which abuts Yiyang, Xiangyin, Changsha, and Ningxiang.

Different standards and different patterns must be adopted in the restructuring of electric powered drainage and irrigation and power grids on the bases of different topography and water system characteristics. When the internal lake, canal and stream area is fairly small and ability to regulate water storage limited, it is necessary to adopt standards such as guarding against a flood such as is encountered once every 10 years, or torrential rains bringing 200-250 millimeters of rainfall within 3 days, or water 50 millimeters deep in fields after 3 days of pumping. When the lake, canal, stream, and ya [0800] river area is fairly large, and there is ample ability to regulate water storage, a standard may be used of 325-405 millimeters of rainfall from 15 days of torrential rains, or complete drainage in 15 days. Using this as a guide, whether using large-scale electrical drainage or small-scale dispersed equipment, an increase in lake region electric drainage from the present 389,000 kilowatts to 600,000 kilowatts would virtually solve the problem of waterlogging and water stagnation such as is encountered once every 10 years. At the same time, the electric power grid should be fully completed and the ditch system fully completed, with inner lake construction work following closely behind.

3. Constructing, Equipping, and Garden Style Farming

Machinery should be used to dig out the lakes and uplift the fields, and to both increase the height and strengthen 1,093 dikes for the prevention of waterlogging covering a distance of 2,982 kilometers, for the building of 8,892 drainage and irrigation ditches over a distance of 24,820 kilometers, and for the building of 5.53 million mu of fields for garden style farming. The inner lake area cannot be further reduced and, if possible, it would be best to allow some fields to revert to lake. Drainage and irrigation systems should be separate; fields and lakes should be separate and water from high fields should be allowed to enter lakes, which regulate water storage. Water from low-lying fields should be drained away at once, and the area from which a crop can be guaranteed despite drought or waterlogging should be steadily expanded. Over a period of time, new socialist villages should be built in the lake region with "fields laid out in squares, trees lined up in rows, irrigation and drainage ditches forming a network, and habitations forming villages."

4. Improved Navigation Channels

Dongting Hu has always been a river network water transportation region. But because of long years of silting, channels have been blocked and transportation is no longer easy. Frequently dikes block passage between inner and outer lakes and between inner and outer rivers causing transportation hardships.

Dredging of flood channels and building of garden style farming, plus dredging of main outer river channels and canals and streams inside dikes would assure normal navigation along the larger navigation routes and help develop short distance transportation inside dikes.

The foregoing actions to bring the lakes under control constitute a short-term program for building lake region water conservancy. Complete solution to Dongting Hu's water conservancy problems requires, first of all, elimination of the threat that flooding of the Jing Jiang poses. Opening of flood diversion channels on the Jing Jiang so that the waters of the river and the lakes flow away separately is a prerequisite for the building of Dongting Hu region marketable grain bases. This task is very closely related to envisioned long-range plans for building reservoirs in the three gorges of the Chang Jiang, and for controlling and impeding flood waters on the Li Shui and Yuan Shui. The new flood channel will carry waters from the Li Shui and the three mouths of the Chang Jiang directly into the Chang Jiang, and will divide the waters of the Xiang, the Zi, and the Yuan rivers. The lower reaches of these three rivers will each have its own independent flood channels for a complete change in the jostling together of the three mouths and the four rivers, the chaotic flow of water, and the choking with silt. This is a fairly huge project that poses rather complex problems. It has a long-term bearing on the fundamental well-being of the entire Dongting Hu region, and it can save areas to the south and north of the Chang Jiang from the threat of exceptionally large floods.

(2) Building Water Conservancy in the Hills and Low Mountains

A large expanse of hills and a fringe of low mountains rim the lakes, and the terrain is undulating and broken up. Cultivated land is fairly concentrated in the central river valley plain where water is also fairly available; elsewhere fields are fairly dispersed. The "three runoffs"--runoff of water, fertilizer and soil--and the threat of summer and autumn drought exist everywhere. Water conservancy problems are currently manifested in the following several ways: (1) Water conservancy has been fundamentally solved; however, projects have not been adequately equipped. In some places insufficient water is available, and designed irrigation standards have yet to be met. Fields have not been leveled for the most part, and this includes most fields in large, medium and small type (1) project irrigation areas. Main tasks for the future are as follows: Wind-up work to complete equipping of projects to meet high standards, good performance in guaranteeing safety and the tapping of potential, a proper amount of new building of projects to impound and divert water, and major efforts in building garden style farming. (2) Most of the places that have not fundamentally solved water conservancy problems and where the land has not been leveled are in the mountains and hills and in some low hill regions that lack water sources. Some of these places have reservoirs, but lack irrigation ditches, or they have ditches but no sluice gates, the ditches leak a great deal, a large amount of work in equipping projects remains to be done, and the projects are formidable. The main direction of future attacks should be to bring projects up to standards, major efforts in "three ditches and one ji [0679]," and improvement of low yield fields. (3) Places that have yet to solve their water conservancy

problems because of high mountains, steep slopes, dispersed farmland, complex geology and topography, and very few water conservancy facilities such as Guniu Shan, Dashuitian, and Waergang in Taoyuan County, Ganqi, Dongshi, and Taiqing in Lixian County, or mountain regions in eastern Linxiang and Yueyang counties can currently guarantee a harvest despite drought or waterlogging from only 30 to 40 percent of the cultivated area. Such places should adapt general methods to local circumstances, should coordinate major projects, and should build small projects to impound and divert water in combination with soil improvement and a good job of farmland capital construction.

Water conservancy statistical data for 1975 shows 242 small type (1) or better reservoirs in mountain and hill regions serving an irrigated area (2,502,200 mu) that is only 72 percent of the designed irrigated area (3,471,400 mu). (Table 58) Continued equipping of existing water conservancy projects, guaranteeing of project safety, strengthening of management, and improvement of irrigation ditch utilization coefficients, in conjunction with the leveling of the land and the building of garden style farming can mean a 30 to 50 percent increase in the area presently served by irrigation. Water conservancy departments everywhere should do all-around planning for section by section building of water conservancy in hill regions around the lake, taking into account natural conditions such as topography and the water system, plus production patterns. In addition to the large irrigation areas that have been built already, they should plan to build additional large irrigation projects at Tieshan (Yueyang), at Miluo, as well as at the neighboring Fuxikou and Liuyang He. They should mostly work to develop irrigation, but should also devote attention to overall benefits to be gained from flood prevention and electric power generation.

Table 58. Statistics on Area Irrigated by Large, Medium and Small Type (1) Reservoirs in Northern Hunan in 1975 (Area: 10,000 mu)

(a) 地区	(f) 大型水库			(j) 中型水库			(k) 小(一)型水库		
	(g) 座	(h) 设计	(i) 已达	(g) 处	(h) 设计	(i) 已达	(g) 处	(h) 设计	(i) 已达
(b) 合计	2	70	51	34	168.51	120.7	206	108.63	78.52
(c) 岳阳				10	59.6	35.93	98	40.54	27.83
(d) 益阳				3	13.1	12.45	18	8.63	7.34
(e) 常德	2	70	51	21	95.81	72.32	90	59.46	43.31

Note: The three prefectures include 10 counties. Since most of Anxiang, Huarong, Nanxian, and Yuanjiang counties are on the lake plain, they have no small type (1) or better water conservancy facilities.

Key:
- a. Prefecture
- b. Total
- c. Yueyang
- d. Yiyang
- e. Changde
- f. Large reservoirs
- g. Number of reservoirs
- h. Designed irrigation
- i. Attained irrigation
- j. Medium size reservoirs
- k. Small type (1) reservoirs

2. A Halt To Reclamation of Lake Land To Expand the Cultivated Area, and Good Performance in Intensive Farming

For a long time, Dongting Hu has been silted by materials carried into it by rivers, and its sandbar islets have increased over the years. Mostly these are found in the eastern, southern, and western Dongting Hu. A small number may also be found in the lower reaches of the four rivers and the channels of the three mouths of the Chang Jiang. The size of the sandbar islets vary as the water level rises and falls. According to 1971 statistics, the lake region had about 2,364,900 mu of sandbar islets. This included the following: 405,200 mu at an elevation of 30 meters or higher (the elevation at Wusong, and the same applies hereinafter); 1,196,500 mu at between 28 and 30 meters high, and 763,200 mu at 28 meters or below. These were found in 11 counties in Yueyang, Yiyang, and Changde prefectures, most of them, or 80 percent of the total sandbar islet area, in Yueyang, Yuanjiang, Hanshou, and Xiangyin counties. (Table 59)

Use of lake sandbar islets for production. For sandbar islets at an elevation of 30 meters or higher, the land has been reclaimed for farming without embankments being built, and rape, radishes, and small quantities of grains other than wheat and rice are grown on 57,900 mu. On 231,600 mu at an elevation of between 28 and 30 meters, spring harvested crops such as rape are also grown. The reed growing area covers 781,500 mu, or 33 percent of the total sandbar islet area (a 1980 survey showed the reed growing area to be 896,200 mu, or 37.34 percent of the sandbar islet area), most of it in the Dongting Hu region (at an elevation of about 28 meters) in Yueyang and Yuanjiang counties. Some was also grown in the western and southern Dongting Hu region at an elevation of 29-30 meters since the water level is high even during the low water season. The remaining 1,293,900 mu sandbar islet area is partly belozem, most of which grows lake grasses and yangzhi [2799 2655]. The very places in which lake grasses proliferate are also places in which oncomelania grow in profusion. Take the eastern Dongting Hu as an example. Snails begin to appear at an elevation of 24.5 meters and above, and the area at 26.5 meters and above has numerous snails. Snails are most dense at between 27.5 and 28.5 meters, and between 29 and 31 meters they begin to become fewer again. Soil with a 30 to 40 percent moisture content where the water flows back and forth frequently also harbors most oncomelania. Huarong, Yueyang, and Yuanjiang counties have killed snails by storing water behind low embankments on lake sandbar islets, and catching fish in the water at the same time. They have built high embankments to reclaim land for farming in lake coves where they have used chemicals to kill snails.

Since the 1970's, embankments have been built one after another to enclose lake land for farming on the Matan outer islets and midway islets in the Dongting region and in Lu Hu, at Weiti Hu in the Dongting Hu region, at Qili Hu, Muping Hu, and the outer islets of Qiong Hu, at Dongnan Hu, and even at Hengling Hu. Though some success has been achieved in eradicating snails, expectations have not been fulfilled for controlling water storage in the lake, or for controlling the water and getting rid of the silt. On the contrary, numerous newly built enclosing dikes have been unable to withstand floodwaters, and tremendous amounts of manpower, material, and financial

Table 59. Table Showing Status of Dongting Hu Region Sandbar Islets (1971)

(a) 地区	(f) 县属	(p) 总面积（万亩）	(q) 利用情况				(w) 高程面积关系			(aa) 当地一般洪水位高程（米）
			(r) 生产面积（万亩）		(u) 芦苇面积（万亩）	(v) 荒洲面积（万亩）	(x) 28米以下	(y) 28—30米	(z) 30米以上	
			(s) 不围而垦	(t) 小围小垦						
(b) 岳阳	(g) 汨罗	2.44	/	/	1.72	0.72	0.56	1.27	0.61	33
	(h) 华容	18.10	0.95	4.36	2.05	10.74	1.97	11.39	4.74	32
	(b) 岳阳	50.00	0.30	6.00	15.00	28.70	20.40	29.30	0.30	32
	(i) 湘阴	22.73	0.83	8.26	4.15	9.49	9.49	12.41	0.83	33
	(j) 小计	92.27	2.08	18.62	22.92	49.65	32.42	54.37	6.48	—
(c) 益阳	(k) 沅江	70.99	1.50	2.50	35.46	31.53	25.92	36.57	8.5	32～33
	(c) 益阳	1.00	/	/	0.30	0.70	/	0.60	0.40	32
	(l) 南县	9.80	/	0.40	7.80	1.60	1.00	6.80	2.00	33
	(j) 小计	81.79	1.50	2.90	43.56	33.83	26.92	43.97	10.90	—
(d) 常德	(d) 常德	2.01	1.13	0.88	/	/	/	0.75	1.26	35
	(m) 澧县	3.21	0.78	0.06	0.58	1.79	/	0.08	3.13	37—38
	(n) 安乡	7.55	0.30	0.70	3.05	3.50	/	/	7.55	36.9
	(o) 汉寿	48.66	/	/	8.04	40.62	16.98	20.48	11.20	34
	(j) 小计	61.43	2.21	1.64	11.67	45.91	16.98	21.31	33.14	—
(e) 总计		236.49	5.79	23.16	78.15	129.39	76.32	119.65	40.52	—

Key:

- a. Prefecture
- b. Yueyang
- c. Yiyang
- d. Changde
- e. Total
- f. County
- g. Miluo
- h. Huarong
- i. Xiangyin
- j. Sub-total
- k. Yuanjiang
- l. Nanxian
- m. Lixian
- n. Anxiang
- o. Hanshou
- p. Total area (10,000 mu)
- q. Utilization
- r. Production area (10,000 mu)
- s. Reclaimed but not enclosed by embankments
- t. Small amount of reclamation and small embankments
- u. Reed growing area (10,000 mu)
- v. Wasteland area (10,000 mu)
- w. Relationship of area elevations
- x. 28 meters and lower
- y. Between 28 and 30 meters
- z. 30 meters and higher
- aa. Usual local floodwater height (meters)

resources have been lost. Meanwhile new lake islets continue to grow without end. As a result of the silting plus enclosing of parts of the lake to make farmland, the lake area has steadily shrunk. It has been estimated that during the 124-year period prior to liberation (1825-1949), the Dongting Hu shrank by 2.47 million mu, i.e., an average 20,000 mu annual decrease in area. During the 30 years following liberation (1949-1979), it has shrunk a total of 2.42 million mu, or an average of 80,000 mu per year. The latter is four times faster than the former. In 1979, the water surface was 37 percent less than in 1949, and capacity fell from 26.8 billion cubic meters in 1954 to 17.8 billion cubic meters, or a 33 percent decline. Sandbar islets and grassy flats now cover more than 2 million mu of the lakes, and the internal lakes have also declined by 40 percent. As a result, there has been no abatement of external flooding or internal waterlogging; on the contrary both have relatively increased. Navigation has been blocked or is roundabout, the reed growing area has diminished, and growth of aquatic products has become restricted. The role of the lakes in regulating environment has weakened, and this has directly affected agricultural production. Therefore, if the life of the lakes is to be extended, and if their ability to regulate storage of water and ecological balance are to be maintained, the laws governing silting will have to be mastered, actions will have to be tailored to circumstances, and flood waters will have to be diverted to release their silt. In addition, new reclamation of lake land for farming will have to stop. Furthermore, when dredging flood channels, digging out the lake and uplifting fields, readjustments will have to be made as specific circumstances dictate in enclosing dikes and old embankments that obstruct the natural flow of waters and block the migration of fish for spawning.

Changes to Dongting Hu have resulted from a long-term process of silting and reclamation of lake land for farming. Because every jurisdiction was a law unto itself in the old society, the lake was divided up and embankments built to reclaim farmland. The water system was in chaos, and no distinction was made between farmlands and lake, so disasters were frequent. Since liberation, remarkable results have been achieved as a result of three major control efforts. However, for want of an overall plan for comprehensive control of rivers and lakes, the problem has yet to be completely solved. Recent reclamation of lake land for farming has not achieved increased output. Even with the present diked area, the land utilization rate still averages only about 57 percent, and soil resources have not been fully and equitably used. For some time emphasis has been on grain to the neglect of economic diversification. Attention was not given to maintaining the ecological balance, and the land could not yield its full bounty. Moreover, stagnation has been serious in diked fields, with gleyed paddy soil accounting for about 60 percent of the total and producing yields that are from 300 to 400 jin lower than ordinary farmland. If farmland capital construction inside the embankments is relaxed, and readjustment and reform of production patterns and the farming system neglected, and if the reclamation of outer sandbar islets is pursued to increase cultivated land in a search far and wide for what lies close at hand, with more land being cultivated for meager yields, this will inevitably lead to a deepening of the vicious cycle in nature. Thus, a genuinely good job of regional agricultural planning must be done, crop patterns actively and equitably readjusted, and production conditions improved so that grain is

grown in places suited to the growing of grain, cotton grown in places suited to the growing of cotton, and fishing done in places suited to fishing, with a good job done in the building of bases, levels of intensive farming constantly raised, and consistent bumper harvests of grain, cotton, hemp, and aquatic products assured.

3. Gradual Development of Agricultural Mechanization

Continued consolidation and improvement of northern Hunan's marketable grain and cotton bases, and advances in depth and in breadth in production require further strengthening of farmland capital construction, vigorous improvement of production conditions such as water, fertilizer, and soil, and active development of scientific farming. Given the characteristics of the lake and plains regions, rapid mechanization of agriculture should be regarded as a major way and a beneficial action for development of production.

At the present time, when the root problems of the Chang Jiang and the four rivers have not yet been solved, avoidance of silting, flooding, and waterlogging in the lake region remains difficult. Objectively, increases in dikes to guard against high water increases burdens. With development of grain production and cash crops, plus other kinds of economic diversification, the seasons press more insistently on people, and the intensity of labor becomes more pronounced. Except for state-owned farms in the region on which the level of farm mechanization is fairly high, in most places not only is mechanized equipment lacking for major operations, but animal power is likewise very inadequate, and the broad masses are more insistently demanding agricultural mechanization. The broad masses must be relied upon in this regard, and there must be self-reliance, all-out efforts to make the country prosperous, and suiting general methods to specific circumstances for gradual acceleration of progress in mechanization.

1. Selection of types and technical improvement of paddyfield farming machines: The region's major farming areas consist of alluvial lakes and plains on which the gradient is between 1 and 3 degrees. Except for the hill regions where the yellow soil is relatively heavy clay, in most of the paddyfields the soil is sandy chao, which ranges from gravely to light clay whose specific resistivity is 0.3-0.6 kilograms per square centimeter. In terms of mechanical composition, the soil's plowing resistivity is largely as shown in Table 60. Since the soil's water content is fairly high, its resistivity increases correspondingly, and resistivity is even somewhat higher for green manure hard slab fields. Since the surface of the land rolls gently and fields are broad, tractors should be mostly large and medium size ones suited to plains areas, with some supplementary small ones. The more than 10 types of Chinese made tractors currently being made can all be used pretty well. However, since most of them are propelled by caterpillar treads, they tend to deepen the depth of paddyfields year by year, with the result that the plow pan becomes broken, and they frequently become mired in fields of deep mud. Thus, how to convert them to high wheeled tractors with treaded tires and other new means of locomotion in order to suit them to local paddyfields has become a research and development item urgently requiring solution. In addition to the large and medium size power machines

introduced from elsewhere, the province has finalized designs and has begun to produce two tractor models that may be selected for use and promoted. (Table 61)

Table 60. Classification of Soil Resistivity

Nature of soil	Sandy soil	Loam	Clayey soil	Light clayey soil	Clay
Soil resistivity (kilograms per square centimeter)	<0.3	0.3-0.4	0.4-0.6	0.6-0.8	0.8-1.0

Table 61. Tractors and Major Features

Tractor name	Complete motive power and main features	Production plant
Dongfanghong-30	Medium-size wheeled tractor. Suited to plowing needs of southern paddyfields. Can be hitched to all sorts of farm implements. Weight: 1,500 kilograms Forward speed: 2.40-24.2 kilometers per hour Traction force: Dryland, 800 jin Wetland, 600-650 jin	Hunan Tractor Plant
Hongqi-20	Medium and small-size wheeled tractor. Suited to wetland operations and equipped with various kinds of farm implements. Weight: <1,000 kilograms Forward speed: 1.66-21.2 kilometers per hour Traction force: 250-600 kilograms	Yueyang Tractor Plant

On hillside or small hill plot paddyfields, various kinds of farm implements that are small in size, light in weight, simple in construction, and that may be operated easily and dependably may be used. The machine plowing boats and power boats currently being used and promoted are a means to develop machine cultivation of paddyfields.

2. Vigorous improvement of transplanters: In the lake and plains region, the fields are larger than available workforces can readily handle, and rush transplanting is a hectic task. Suitable transplanting machines are urgently needed. The Dongfeng 2A machine powered transplanter, whose design has been finalized and which has gone into production, is technically quite good, and is easy to operate, adjust, and repair, making it suitable for all-around use. Table 62 shows its work efficiency. Further research and development is required.

Table 62. Work Efficiency of Dongfeng 2A Transplanter

Distance between plants	3 cun	4 cun	5 cun	6 cun
Work efficiency	2.0 mu/hr	2.5 mu/hr	3.0 mu/hr	3.5 mu/hr

3. Further bolstering drainage and irrigation machines: Ever since the mid-1960's when the lake region made major efforts in drainage using electrically powered machines, its ability to withstand calamities and insure a harvest have improved. Still, the threat of drought and waterlogging has still not been completely eliminated. This region might do well to introduce the large axial flow pumps that fraternal provinces and municipalities are already producing, while researching and developing equipment itself. Emphasis should go to development of large drainage and irrigation machines to meet needs in draining large amounts of water and withstanding severe drought. It should actively develop spray irrigation equipment, which would not only effect a saving of half the water used, but which would also help crop growth and development.

4. Farmland capital construction machinery: Further improvement of water conservancy construction, digging out of lakes and making upraised fields, and gradual improvement in the accumulation of silt in rivers and lakes requires dredges of various sizes as well as development of bulldozers and carry-scrapers. In addition to the construction of water conservancy is the leveling of large areas of land, and development of garden style farming, which requires active research and development based on mechanized equipment that has already been imported or promoted, to provide rotary equipment for hand tractors that can level land, make furrows, lay pipe, dig ditches, and remove silt.

5. Development of processing machinery for cash crops and agricultural sideline products: Both area planted and output of cash crops such as cotton, rapeseed, and hemp, as well as tea, and citrus is substantial; yet the production process depends mostly on hand labor. Native methods for pressing oil from rapeseed, for example, results in low oil yields, and hand picking of tea is slow. This makes farm work hectic. Thus, active research and development is necessary to produce machines that clean and steam rapeseed, and extract and refine oil from it in a continuous process. The Xiangcha Model 400 tea picker, the design of which the province has approved, should be used and promoted. Powered hemp washing machines can be used to clean jute, and the Yuanjiang No 2 jute scraper is more than again as work efficient as hand scraping. Research, development, and promotion are underway for machinery that can level cotton and hemp fields, can sow seeds, cultivate to eliminate weeds, pick cotton, strip away cotton plant stems, and process cotton, as well as machines that can harvest reeds and lake grasses.

6. Research and development, and equipping with animal husbandry and fishing industry machines: Energetic development of hog raising requires a full range of machines with broad applications to pulverize or chop livestock

fodder, machines to process refined or coarse feed for hog farms, to provide feed and water, and to remove dung. Qunshan Farm is gradually being equipped with such machines. Machinery used in fishing industry production to increase oxygen supply and to clean ponds, plus fishing machinery and deep water fishing machines that can be used on mechanized junks as well as guajiang [2229 2862] used in agriculture are being actively developed for use, and will help reduce the intensity of labor, increase work efficiency, and increase yields.

Chapter 4. Central Hunan and Eastern Hunan Agricultural Regions

The central Hunan and eastern Hunan agricultural region is located somewhat east of the central part of the province. It neighbors the Dongting Plain to the north, abuts the southern Hunan hill region to the south, is adjacent to western Hunan to the west, and borders Jiangxi Province to the east. It includes Pingjiang County in Yueyang Prefecture; Xiangxiang, Xiangtan, Liuyang, Liling, Youxian, and Chaling counties plus Xiangtan City in Xiangtan Prefecture; Taojiang and Ningxiang counties in Yiyang Prefecture; Lianyuan, Xinshao, Shuangfeng, and Shaodong counties plus Lengshuijiang City and Shudi City in Lianyuan Prefecture; Shaoyang County and Shaoyang City in Shaoyang Prefecture; Hengshan, Hengyang, Hengdong, Hengnan, and Qidong counties plus Hengyang City in Hengyang Prefecture; Changsha City, Changsha County, and Wangcheng County; Zhuzhou County, and Zhuzhou City, which contain a total of 1,111 communes (or towns), have a population totaling 19,897,400 (of which the agricultural population numbers 16,889,300), 16,576,800 mu of cultivated land (of which 13,872,800 mu is paddyfields), and 2,704,000 mu of drylands. The land area is 53,300 square kilometers making these regions second only to the western Hunan agricultural region in size.

Since the founding of the nation, very great successes have been scored in the region's development of agriculture. Grain output in 1979 was 2.18 times greater than in 1949, and accounted for 38 percent of total grain production in the province. The regions produced 42.4 percent of the whole province's tea output, and about one-third the province's total output of citrus fruit. These regions have a long history of hog raising. In 1979, the region raised more than 15 million head, and removed 6.87 million head from inventory, or 43 percent of the total for the province. This region has held first place in hog production for many years. In 1979, the region produced more than 40 percent of the province's gross output of fresh fish. This region holds a fairly important position in agricultural production in the province, and has made a definite contribution to the support of industrial and mining cities and to foreign trade.

Second Section. Features of Agricultural Production

1. Fairly High Per Unit of Area Grain Yields, But Slow Increases Recently

This region accounts for 87 percent of the cultivated land in the province devoted to grain production, and for about 67 percent of the total area sown to farm crops. Paddy rice holds overwhelming dominance in grain production.

Grain output has climbed steadily since liberation. In 1949, the entire region produced only 5.284 billion jin, and 8.083 billion jin in 1965. In 1970, the amount increased to 10.743 billion jin, and in 1975, it rose to 13.789 billion jin and again climbed in 1979 to 16.827 billion jin. During the past several years, the region has annually provided the state with about 36 percent of all marketable grain provided by the province as a whole. In 1979, Xiangtan, Xiangxiang, Liuyang, Liling, Youxian, Chaling, Pingjiang, Ningxiang, Shuangfeng, Hengyang, Hengnan, Hengdong, Changsha, Wangcheng, and Zhuzhou counties each provided the country with more than 100 million jin of grain, with Xiangtan, Liuyang, Ningxiang, Hengyang, and Hengnan counties each providing more than 200 million jin. Clearly, not only is this region's yields per unit of area high, but it is also the major grain producing area in the province and a region that produces a substantial amount of grain.

The region's paddyfields occupy 84 percent of its total cultivated land area. The paddy growing area rose from the former approximately 70 percent of total area sown to grain crops to 87.1 percent, and in 1979 it rose again to 88 percent covering a 24.92 million mu area. From 1971 to 1975, paddy output amounted to 92-93.5 percent of total grain output, and in 1979 paddy output was 15.789 billion jin, or 93.8 percent of total grain output.

Development of grain production since liberation, and particularly the achievement of fairly high paddy yields per unit of area is attributable largely to the following several effective measures:

(1) Major efforts in water conservancy construction, and increase in ability to assure a harvest from paddyfields. Take Changsha and Wangcheng counties, for example. During the period immediately following liberation, these two counties were able to impound, divert or lift only 240 million cubic meters of water. By 1979 this amount had increased to 910 million cubic meters for a 2.8-fold increase. Farmland from which a crop could be guaranteed despite drought or waterlogging rose from 200,000 mu in 1952 to 1.05 million mu, or 78.5 percent of the paddyfield area. Today, 10 billion cubic meters can be impounded, diverted or lifted throughout the region, and the farmland area from which a crop can be assured despite drought or waterlogging has increased to 11.6 million mu, or 83.5 percent of the paddyfield area. This includes 90 percent or more of the paddyfields in Xiangtan, Hengshan, Hengyang, Hengdong, Ningxiang, Liling, Youxian, and Shaodong counties. The paddyfield area of individual communes (or towns) throughout the region from which a crop can be guaranteed despite drought or waterlogging is also on the rise.

(2) Reform of the farming system and expansion of the paddyfield multiple cropping index. Practice has shown that not only are two crops of rice

suitable for growing in this region, but that they are also a major way in which to increase yields. As water conservancy conditions have improved, the former single rice crop has given way to the growing of two crops of rice in succession. In addition, two crops of intercropped rice have given way to continuously cropped rice, and by 1969, the entire region had virtually become a double crop rice growing area. During the past several years, the double crop rice growing area has been maintained on about 90 percent of the paddyfield area. Paddy yields for the region averaging nearly 500 jin per mu in 1965 increased to 1,215 jin per mu in 1979 for a further increase in paddy yields per unit of area.

(3) An expansion in sources of manure has occurred as a concomitant to reform of the paddyfield farming system. In addition to increasing the raising of hogs and going in big for mud fertilizer and increased use of chemical fertilizer, all jurisdictions have steadily increased the winter growing of green manure in paddyfields. In recent years, the green manure growing area has amounted to more than 70 percent of the paddyfield area, in the development over a wide area of a three crop system of rice-rice-green manure.

In addition to grain, this region also grows wheat and sweet potatoes. Wheat production consists mostly of winter wheat, most of it grown on drylands. During the past several years, the wheat growing area has amounted to between 2.8 and 3.7 percent of the grain growing area, and output is 0.81-1.14 percent of total grain output. In 1975, 1.03 million mu of wheat was grown to surpass the all-time high to break the 1 million mu mark and gross output was 139 million jin. In 1979, an output of 192 million jin was obtained from a 1 million mu area, an all-time high. Within the region, wheat is grown in the southwest, in Lianyuan, Xinshao, Shaoyang, Qidong, Hengyang, and Hengnan counties around Hengshao, and in Pingjiang and Ningxiang in the north. Most of it is grown on hill region drylands, but some of it is grown in paddyfields.

Sweet potatoes have historically been an important dryland grain crop for this region. The Pingjiang County annals report a more than 150-year history of growing rice and sweet potatoes in that county. Between 1971 and 1975, the region's sweet potato growing area covered approximately 1.5 million mu, which was between 5 and 5.6 percent of the grain growing area. Output amounted to between 600 million and 880 million jin, or between 4 and 6.4 percent of gross grain output. This included a 1,386,000 mu growing area that produced 680 million jin of sweet potatoes in 1979, which was 4.9 percent of the grain growing area and 4 percent of gross grain output. In this region, sweet potatoes are grown in the identical areas of the southwest where wheat is grown. In order to increase sweet potato yields per unit of area, Honglian Eighth Brigade in Qixing Commune, Lianyuan County began to sprout seedlings in warm frames, thereby increasing the transplanting of seedlings for intercropping with wheat. In 1973, sweet potatoes were intercropped with wheat on 27.8 mu of drylands for fresh sweet potato yields averaging 3,910 jin per mu, and wheat 370 jin per mu. Two crops of wheat and sweet potatoes amount to 1,180 jin per mu of grain, surpassing the 1,000 jin mark. However, most of the sweet potato yields per unit of area in this

region are not high, mostly because of the lack of water conservancy facilities and the resultant threat from summer and autumn drought. Therefore, building water conservancy works for drylands must be intensified, and there must be further action to improve the soil and increase its fertility to lay a foundation for consistently high yields.

During the past 10 years, this region's grain production has increased by an annual average 600 million jin. However, in some years the average amount of increase has not been great. For example, the increase between 1975 and 1971 was only 1.58 billion jin, or an average annual increase of only 395 million jin, which was lower than the average annual increase for the past 10 years. Two conspicuous problems exist as follows:

(1) Rise in average grain yields per mu is slow, and differences from one prefecture to another are striking. A look at average yields per mu for the whole region show yields to have been 837 jin per mu in 1971 and 946 jin per mu in 1975, a production increase of only 109 jin per mu over 4 years and an average annual increase of only 27.2 jin. In 1979, by contrast, yields per mu were 1,165 jin per mu, 219 jin higher than in 1975, or an average annual increase of 54.8 jin. A look at individual counties shows 13 counties as having had a rate of increase higher than the average for the whole region for 1975 versus 1971. Most of these counties were in the eastern, western, and southern parts of the region, including Chaling County with a 288 jin increase, making it the county with the highest increase in the region with an annual 72 jin average increase. Second was Shaodong County, with a 260 jin increase. Most of the counties with increases lower than the average for the entire region were located in the north. These included Changsha County whose 1975 yields were 20 jin less than in 1971.

(2) Fairly slow increase in early rice throughout the region, and low and inconsistent grain yields for all other seasons. A look at yields per mu for major grain crops in the region shows yields of between 567 and 623 jin per mu from double cropped early rice for the past several years, and a 56 jin increase in yields per mu between 1971 and 1974. Between 1971 and 1975, the increase was only 33 jin, or an average increase of only 8 jin per year. Yields per mu of other crops such as double cropped late paddy and of wheat and sweet potatoes also remain low and inconsistent. In 1974, late rice accounted for 50.2 percent of the double crop rice area and for 44.2 percent of the area sown to grain crops. But as a result of serious drought, which reduced yields, output was only 34.2 percent of gross paddy output and 32 percent of gross grain output. Clearly output of late paddy has a substantial effect on output of paddy and grain. (Table 66)

Main reasons why late paddy output is neither high nor consistent are as follows:

(1) Threat from drought, and water conservancy construction's inability to keep pace with needs for development of double crop paddy (Figure 33). Existing fields able to guarantee a crop despite drought or waterlogging all grow double crop late rice, and also amount to only 84 percent of the double crop rice area. These fields are found over a wide area, and are prone to drought damage.

Table 66. Average Yields Per Mu of Paddy, Wheat, and Sweet Potatoes for the Whole Region 1971-1979

项 (a) 目		1971年	1972年	1973年	1974年	1975年	1979年
(b) 全年粮食平均亩产		837	844	935	874	948	1165
(c) 其中	(d)双季早稻	567	567	572	623	600	695
	(e)双季晚稻	363	338	420	323	414	575
	(f)小麦	缺	130	121	141	177	191
	(g)红薯	缺	561	590	404	552	488

Key:

a. Particulars
b. Average grain yield per mu for the whole year
c. Including
d. Double crop early paddy
e. Double crop late paddy
f. Wheat
g. Sweet potatoes

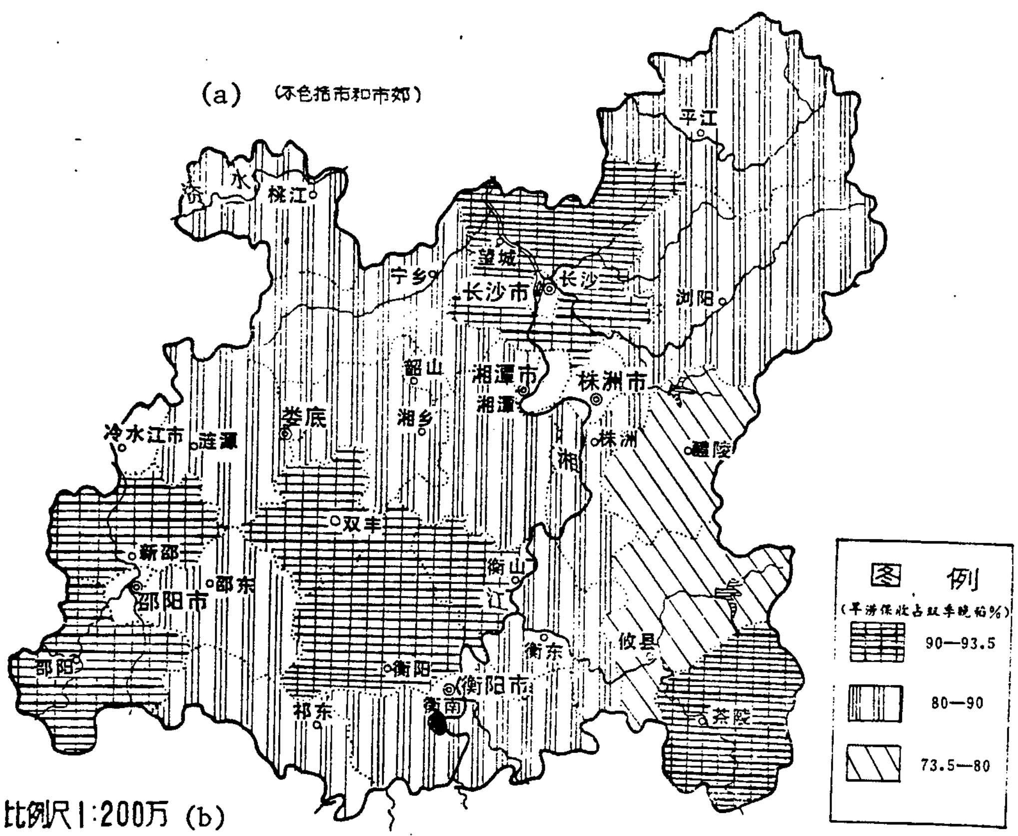


Figure 33. Map Showing Percentage Distribution of Double Crop Late Rice Paddyfields in the Central and Eastern Hunan Region Capable of Guaranteeing a Crop Despite Drought or Waterlogging

Key:

a. (not including cities and suburbs)
b. Scale 1:2,000,000
c. Legend
d. Percent of double crop late paddy from which a harvest can be guaranteed despite drought or waterlogging

(2) Lack of fertilizer. The amount of fertilization given late paddy is low everywhere, and this is one of the main reasons why yields are not high.

(3) Effects of cold dew winds.

Despite the foregoing, there are numerous favorable conditions for the growth of late paddy. In particular, ample sunlight and cumulative heat are more favorable than for the early paddy. In Changsha Prefecture, for example, there are 673 hours of sunshine during the growing season for early paddy, but 831.1 hours for late paddy, which is 23.5 percent more than for early paddy. Effective cumulative temperature during the early paddy growing season is 3,088.2°C; during the late paddy growing season, it is 3,420.3°C, 10.8 percent higher for late paddy than for early paddy. Thus, full use of these favorable resources, intensification of measures to withstand drought and avoid cold dew winds can make possible not only an increase in late paddy yields per unit of area, but can also produce yields that are greater than those for early rice.

2. Rapid Development of Hogs, Tea, and Fruit, With a Small Proportion of Other Cash Crops

Since liberation, simultaneous with this region's vigorous development of grain production has been corresponding development of the hog raising industry, and of tea and fruit production.

(1) Large numbers of hogs raised, and a high marketable rate.

This region has a tradition of hog raising, which is widespread. It annually raises between 40 and 42 percent of all the hogs raised in the province. In recent years in particular, hog raising has developed rapidly, reaching 15,055,600 head by 1979, or 40.19 percent of all hogs in the province. This was a 5,125,600 head increase over the 9.93 million head of 1971, for a 640,700 annual increase. An average of 0.89 head of hogs were raised per capita of agricultural population, which was a higher figure than for the other three agricultural regions. Reasons are as follows: (1) The broad masses of commune members have experience in the intensive raising and care of hogs. Historically, they have raised hogs in sheds feeding them fine and coarse food in combination with cooked food. (2) Abundant sources of hogs: For example, Liusha He in Ningxiang County, Shaziling in Xiangtan County, and Daweizi in Changsha County, all of which are in this region, are provincial centers for the production of superior breed hogs. Once hog breeds have been improved, in particular, they are superior in their speed of growth and the time required to fatten them is shortened. These superior breed hogs not only supply all places in the region, but are also sold elsewhere inside and outside the province. (3) Abundant fodder: As a result of increased grain production, sources of fine feed have become more numerous and varied. For example, odd corners of land beside fields and hill wastelands have been used to grow buckwheat, sweet potatoes, and pumpkins, as well as green fodder containing much juice such as cabbage and radishes, and ponds have been used to grow aquatic plants and various kinds of wild fodder for a steady increase in sources of fodder. (4) Intensification of prevention and

control of hog diseases. (5) Many hogs produce much manure, which produces more grain. Grain and hogs are mutually sustaining.

Since conditions for development of hog production in this region have definitely improved, the period required to fatten hogs has been greatly reduced. Today it takes only 8 or 9 months to fatten a hog. A small number of places such as Hewanqiao and Dongwu communes in Ningxiang County take only 6 months, and fattened hogs weigh as much as 140 jin, thereby increasing the fattened hog removal from inventory rate. In 1979, 6,878,700 hogs were removed from inventory for a 45.69 percent removal from inventory rate. This was somewhat higher than the average for the province as a whole (43.39 percent). During the same year, 3,786,600 head of hogs were sold to the state for a 55.05 percent marketable rate. This was also somewhat higher than the average marketable rate for the province as a whole (54.67 percent). Of the 22 counties in the region, except for Hengshan County, all had a hog removal from inventory rate of more than 100,000 head. Except for Hengshan and Chaling counties, all sold more than 100,000 head to the state. Changsha, Liuyang, and Xiangtan counties each sold more than 200,000 head of fattened hogs to the state, with Changsha County selling 300,000 head to take first place in the province with a 60 percent marketable rate. In addition, Ningxiang, Changsha and Xiangtan counties annually shipped superior breed piglets to the Ministry of Foreign Economic Relations and Trade for reproduction and for sales abroad. In 1975, Ningxiang County's sales of piglets totaled more than 542,000 head.

The rapid development of hog production in this region has not only provided hogs for industrial and mining cities and for export, but has also provided a certain quantity of hog manure. Ningxiang County statistics show an average of more than 20 dan per mu of hog manure used on fields annually, which is about one-third of the total amount of fertilizer used. This not only helps improve the soil, but also helps cut production costs and promote increased yields. Nevertheless, current development of hog production in the region does not meet demands. Calculations show an average of only 0.91 head per mu of cultivated land. Except for seven cities (or suburbs) plus Changsha, Wangcheng, Lianyuan, Xinshao, and Shaodong counties, which have achieved "1 mu, 1 hog," a definite gap exists in all other counties. In terms of numbers of hogs in inventory, the region averages only 0.49 head per mu, an even greater gap. Consequently, continued increase in the numbers of hogs raised, further shortening of the fattening time, and increase in the rate of removal from inventory are still important tasks in raising the region's level of agricultural production.

(2) Large tea growing area, and large output.

This region has a long history in tea production. As long ago as the Guangxu era in the Qing Dynasty, Changsha, Pingjiang, and Liuyang were already producing prodigious quantities of black tea. The local masses accumulated plentiful experiences in the growing, care, and processing of tea, and tea production saw definite development. Subsequently as a result of the depredations of the Japanese invaders and the Kuomintang reactionaries, large numbers of tea plantations went to ruin and output declined markedly to be revived and developed only after liberation (Table 67).

Table 67. Table Showing Development of Tea Production in Central Hunan Region

(a) 项 目	1965年	1971年	1975年	1979年
(b) 面 积 (万亩)	22.36	58.44	101.31	108.32
(c) 总 产 (万担)	10.88	14.90	30.26	48.65

Key:
a. Particulars
b. Area (10,000 mu)
c. Gross output (10,000 dan)

The foregoing table shows clearly the following: (1) A striking expansion in area. In 1971, the tea plantation area was 161.4 percent larger than in 1965, and in 1975 it was 73.4 percent larger than in 1971. The 1979 area was 43.12 percent of the total tea growing area in the province, and 4.84 times the 1965 area. (2) Output increased remarkably. In 1971, output was 36.9 percent higher than in 1965, and in 1975 output was 103.1 percent higher than in 1971. Tea output in 1979 accounted for 42.43 percent of output for the province as a whole, and was 4.47 times greater than in 1965. The past 10 years have witnessed an increase averaging 42,000 dan annually. Both the region's tea plantation area and output hold first place among the province's four major agricultural regions. Speed of development of tea production has been most rapid in Taojiang County. In 1965, that county had a tea plantation area of only 4,700 mu, which produced 4,800 dan of tea. By 1979, the county's tea plantation area had increased to 160,000 mu, making it second only to Anhua County in the whole province, with a 34-fold expansion over 1965. Tea output reached 110,000 dan, vaulting the county into the ranks of a national tea base county. It was second only to Anhua County in the province, with Linxiang County in third place. In addition, numerous noted teas of rather fine quality appeared in the region, teas such as the black tea from Pingjiang and Liuyang counties, "Gaoqiaoyinfeng" from Changsha, "Shaofeng" from Shaoshan County, and "Weishanqingcha" from Ningxiang, all of which are famed inside and outside the province. "Gaoqiaoyinfeng" has become one of the country's 10 noted teas. In recent years, a new tea, "Xiangbolu," has been refined from the foundation laid by "Gaoqiaoyinfeng." It is characterized as "having leaves that are compact and slightly curled with marked jade green color and luster; it produces a bright and completely clear colored liquid that has a noble and brisk aroma and a mellow and refreshing taste. The base of leaves is yellowish green and tender throughout." It has been warmly welcomed by the masses.

Except for Changsha and Zhuzhou cities (and suburbs), the region's tea plantations are divided among three main tracts as follows: (1) The northwest tract. Every county's area is between 100,000 and 160,000 mu. This includes Taojiang, Ningxiang, and Lianyuan counties. (2) The northeast tract. Every county's area is between 50,000 and 100,000 mu, including Pingjiang, Liuyang, and Changsha counties. (3) The south central tract. This may be subdivided into three types. One type is counties having a fairly large area such as Shuangfeng County with 74,700 mu. One type is

counties with a fairly small area such as Youxian, Chaling, Hengshan, Xinshao, Shaoyang, and Qidong, the area of each of which is less than 20,000 mu. The other type is counties with between 20,000 to 50,000 mu, i.e., all counties other than those included in the foregoing two types. Statistics from 1975 survey data (Table 68) show 613 communes (or towns) in the region as having a tea plantation area of more than 500 mu. This is 53.1 percent of the total number of communes (or towns). Of this total, 485 had between 500 and 2,000 mu, which was 79.1 percent of the 613 tea plantation communes. Clearly this region's tea plantations not only extend to every county and city (or suburb), but the tea plantation area of most communes (or towns) is around 2,000 mu. The area of a small number of communes is also greater than 5,000 mu. Examples include Longxi in Taojiang County and Lianhuashan in Ningxiang County, which have more than 8,000 and 8,400 mu respectively. A look at the distribution of major tea plantations in the region (See Figure 34) shows communes with a more than 1,000 mu area as being mostly in hill and low mountain regions, most of them concentrated in the northwest tract and the northeast tract. Statistics show six counties in these two large tracts as having a total of 225 communes, or 59.8 percent of the tea plantation communes in the region of more than 1,000 mu, and 60.2 percent of communes in the six counties. In addition a considerable number are also found in Shuangfeng and Shaodong counties in the south central tract where there are 57 communes, 15.1 percent of the communes of more than 1,000 mu and 60.7 percent of the communes in the two counties. Other counties and cities (or suburbs) have relatively fewer, and most of these are at isolated sites or in a line. As a result of uneven development from one area to another, tea output also differs very greatly (Table 69).

The northwest and northeast tracts produce the largest amounts. Output from the six counties in these two tracts is more than 60 percent of the total for the whole region, and annual tea output of each county is more than 20,000 dan. Output for the northwest tract is most pronounced, approaching one-half the total output of the entire region, and output of Taojiang and Lianyuan counties holds first and second place respectively in the whole region. Although output of the vast south central tract is greater than that of the northeast tract, it has a large number of counties, and counties producing more than 10,000 dan of tea are few. Except for Shuangfeng, Shaodong, Xiangxiang and Liling counties, all others produce less than 10,000 dan.

The main problem existing today in tea production is not very high yields per mu and unevenness in yields. Yields average only 45 jin per mu for the region, but for a few counties such as Lianyuan, Shuangfeng, and Taojiang, yields average more than 55 jin per mu. For most counties, the average is less than for the region as a whole. This is particularly true for the "four Heng's" [Hengyang, Hengnan, Hengshan, and Hengdong counties] in the south where yields are less than 20 jin per mu. Quite a few individual communes and brigades (or farms) have had yields of more than 100 jin per mu, and some communes (or farms) and brigades have "exceeded 200." However, quite a few other communes and brigades have yields of only a few jin per mu. Most important for the future is intensification of cultivation and care of existing tea plantations, replacement of species, and improvement of irrigation, gradual

building of high standard tea plantations, improvement of black tea processing technology, production of more green tea and jasmine tea, and improvement of both yields per unit of area and quality.

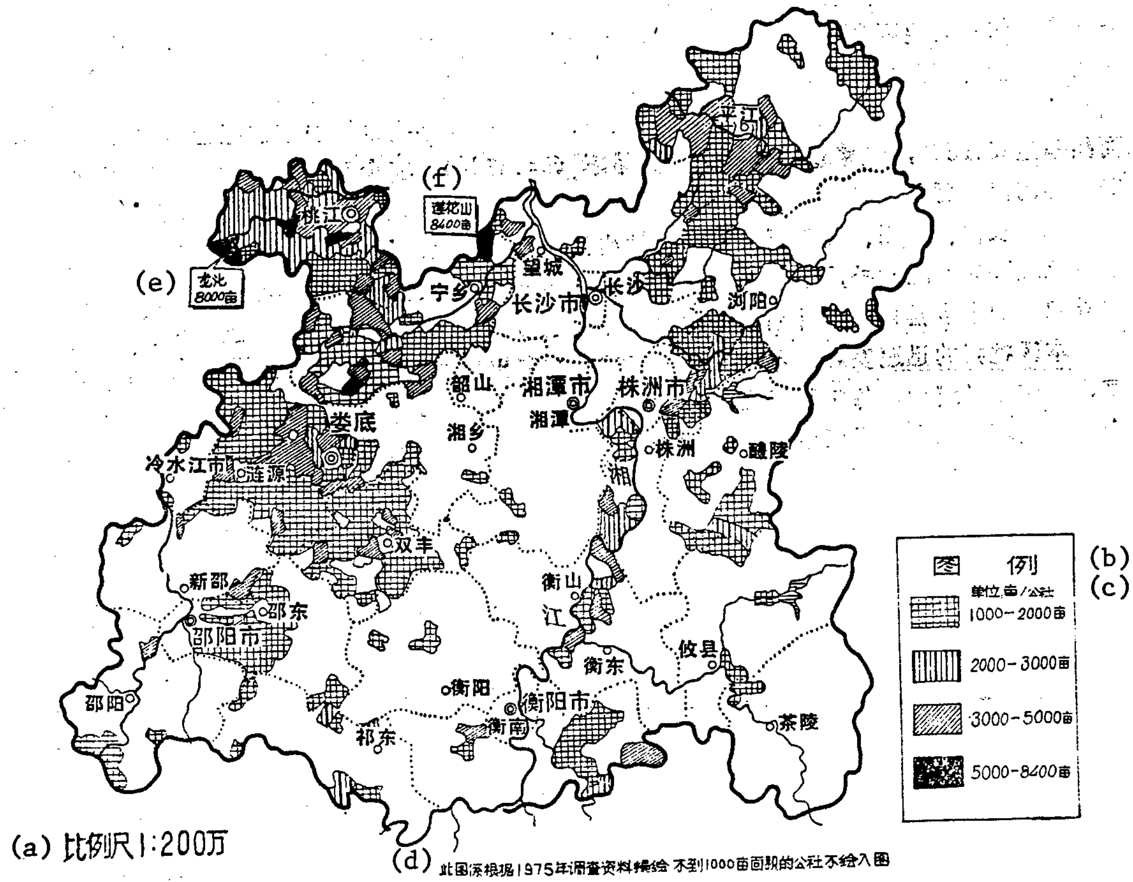


Figure 34. Map Showing Distribution of Tea Plantations in Central and Eastern Hunan Province

Key:

a. Scale 1:2,000,000
b. Legend
c. Units: mu per commune
d. This map is based on 1975 survey data. Communes with an area of less than 1,000 mu have not been included on the map
e. Longxi, 8,000 mu
f. Lianhuashan, 8,400 mu

Table 68. Statistical Table Showing Communes (or Towns) With a Tea Plantation Area of More Than 500 Mu in the Central Hunan Region in 1975

(c) 级 (b) 斤 (a) 县市名称	(d) 500—1000亩	(e) 1000—2000亩	(f) 2000—3000亩	(g) 3000—5000亩	(h) 5000—8400亩	(i) 各县、市(郊)合计
(j) 湘潭县	16	5				21
(k) 湘乡县	14	7	3			24
(l) 醴陵县	15	10				25
(m) 浏阳县	16	20	3	2		41
(n) 攸县	8	4		1		13
(o) 茶陵县	4	1	1			6
(p) 湘潭市	3	1				4
(q) 平江县	16	21	9	2		48
(r) 宁乡县	18	33	12	5	2	70
(s) 桃江县	1	10	13	20	3	47
(t) 邵阳县	8	4	1			13
(u) 邵东县	13	17	3			33
(v) 双丰县	13	32	5			50
(w) 涟源县	3	35	15	3		56
(x) 新邵县	12	4	2			18
(y) 邵阳市						
(z) 冷水江市	1	2				3
(aa) 衡阳市	1					1
(ab) 衡南县	11	8	4		1	24
(ac) 衡阳县	12	4	1			17
(ad) 衡山县	5	1				6
(ae) 衡东县	4	4	4	1		13
(af) 祁东县	4	7		4		15
(ag) 长沙县	28	13	4			45
(ah) 长沙市郊	2					2
(ai) 株洲县	7	5	2	2		16
(aj) 株洲市郊	2					[illegible]
(ak) 全区合计	237	248	82	40	6	613

Key:

a. Name of county or city
b. Jin
c. Level
d. 500-1,000 mu
e. 1,000-2,000 mu
f. 2,000-3,000 mu
g. 3,000-5,000 mu
h. 5,000-8,400 mu

i. Total counties and cities (suburbs)
j. Xiangtan County
k. Xiangxiang County
l. Liling County
m. Liuyang County
n. Youxian County
o. Chaling County
p. Xiangtan City
q. Pingjiang County
r. Ningxiang County
s. Taojiang County
t. Shaoyang County
u. Shaodong County
v. Shuangfeng County
w. Lianyuan County
x. Xinshao County
y. Shaoyang City
z. Lengshuijiang City
aa. Hengyang City
ab. Hengnan County
ac. Hengyang County
ad. Hengshan County
ae. Hengdong County
af. Qidong County
ag. Changsha County
ah. Changsha suburbs
ai. Zhuzhou County
aj. Zhuzhou suburbs
ak. Total for whole region

Table 69. Statistical Table Showing Central Hunan Region Tea Output in 1979

	项 (a) 目	产 (b) 量（万担）	(c) 占全区比重（%）	年产2万(d)担以上的茶叶县
(e)	全 区	48.65	100	8个 (i)
(f)	西 北 片	22.29	45.82	桃江11.00万担 涟源5.97万担 宁乡5.32万担 (j)
(g)	东 北 片	7.74	15.91	平江2.96万担 长沙2.04万担 浏阳2.74万担 (k)
(h)	中南片及市（郊）	18.62	38.27	双峰4.29万担 邵东2.27万担 (l)

Key:
a. Particulars
b. Output (10,000 dan)
c. Percent of whole region
d. Tea counties producing more than 20,000 dan annually
e. Whole region
f. Northwest tract
g. Northeast tract
h. South central tract and cities (or suburbs)
i. 8
j. Taojiang, 110,000 dan; Lianyuan, 59,700 dan; Ningxiang, 53,200 dan
k. Pingjiang, 29,600 dan; Changsha, 20,400 dan; Liuyang, 27,400 dan
l. Shuangfeng, 42,900 dan; Shaodong, 22,700 dan

(3) Rapid development of citrus, but great fluctuations.

More citrus is grown in this region than any other kind of fruit. Marketable rates are high and occupy a leading position among all kinds of fruits. Citrus growing has a long history in this region, and quality is good. More than 800 years ago (during the Northern Song period), Shaoyang City was already growing citrus fruit. Hengdong County's Guang oranges (honey oranges) have an 11.4 percent sugar content, and the Guang oranges from Baimazhou in the same county have a 12.7 percent sugar content. More than 40 years ago, Shaoyang introduced Wenzhou honey tangerines, and after many years of

careful cultivation, they have become a superior tangerine with abundant juice and just the right amount of sweetness and tartness, which are sold throughout North America. Kumquats from Liuyang, and southern tangerines from Changsha are also sold in some European countries.

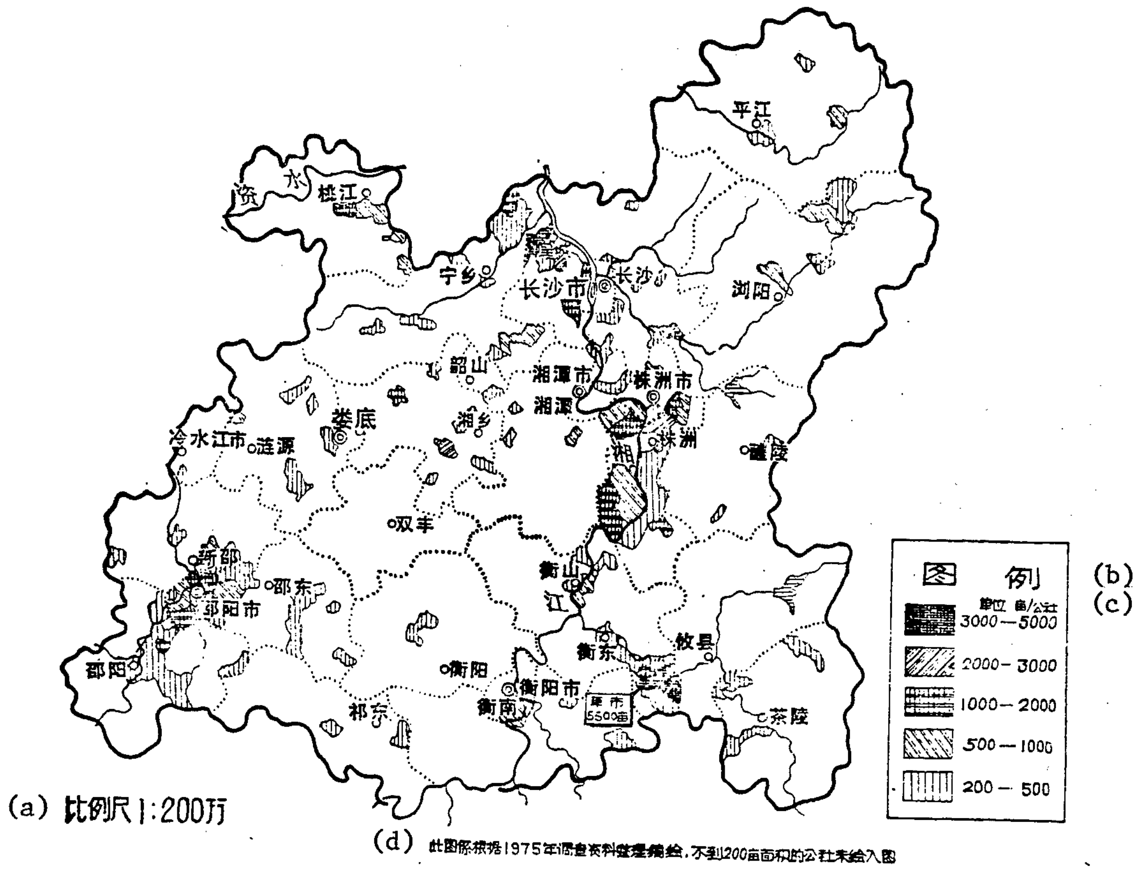


Figure 37. Map Showing Distribution of Major Citrus Orchards in the Central and Eastern Hunan Agricultural Region

Key:

a. Scale 1:2,000,000
b. Legend
c. Units: mu per commune
d. This map is based on the collation of 1975 data. Communes less than 200 mu in area have not been included in the figure.

(4) Slow increases in cotton and oil, and a small percentage of cash crops.

In 1979, cash crops took up 5.85 percent of the region's cultivated land, the smallest percentage in any of the four agricultural regions.

Cotton and rapeseed are the region's two most important cash crops, and though they have developed during the past 10 years, development has been slow (Table 71).

Table 71. Development of Cotton and Rapeseed in the Central Hunan Region

(a) 项目	1965年			1971年			1975年			1979年		
	(d) 面积 (万亩)	(e) 亩产 (斤)	(f) 总产 (万担)	(d) 面积 (万亩)	(e) 亩产 (斤)	(f) 总产 (万担)	(d) 面积 (万亩)	(e) 亩产 (斤)	(f) 总产 (万担)	(d) 面积 (万亩)	(e) 亩产 (斤)	(f) 总产 (万担)
(b) 棉花	39.5	39.8	15.73	46.4	36.7	17.05	56.9	42.7	24.3	39.51	52.5	20.73
(c) 油菜籽	77.1	52	40.60	53.5	68.5	36.6	72.7	66.7	48.5	175.09	89.1	155.97

Key:

a. Particulars
b. Cotton
c. Rapeseed
d. Area (10,000 mu)
e. Yields per mu (jin)
f. Gross output (10,000 dan)

This table shows that during the 10-year period 1965-1975, cotton yields increased by an average 8,570 dan annually, and rapeseed yields by 7,900 dan, increases of 2.9 jin and 14.7 jin per mu respectively. Despite increases in cotton yields per unit of area in 1979, gross output was less than in 1975 as a result of reduction in the growing area. The area planted to rapeseed was increased, and yields per unit of area also rose. Gross output was more than double what it had been in 1975. Tbe region's cottonfields are concentrated mostly in three tracts as follows: (1) The tract in the lower reaches of the Xiang Jiang and the Zi Shui. This is the major cotton growing area in the region, the cottonfields in Taojiang, Ningxiang, Xiangtan, Xiangxiang, Changsha, and Zhuzhou accounting for approximately 35.4 percent of the region's cottonfield area. Each county has between 18,000 and 55,000 mu of cottonfields, and yields range from 40 to 85 jin per mu. (2) The Hengyang and Hengnan County tracts in the middle reaches of the Xiang Jiang. These are located mostly in Hengyang and Hengnan counties, and accounted for 17 percent of the whole region's cottonfield area. Cottonfields in each county cover more than 30,000 mu, and yields range from 34 to 67 jin per mu. (3) The Lianshao tract. This is located mostly in Shaoyang, Shaodong, Lianyuan, and Shuangfeng counties, with between 10,000 and 20,000 mu of cottonfields in each county. Cottonfields in these four counties account for 13 percent of the whole region's cotton growing area, but yields are fairly low ranging from about 27 to 49 jin per mu. In addition, cottonfields may be found in other counties too, most of them about 10,000 to 20,000 mu in area and producing yields of about 30 jin per mu. Rapeseed is found mostly along both shores of the Xiang Jiang and in five counties of Xiangdong Prefecture. Most rapeseed is grown in Changsha, Wangcheng, Xiangtan, Hengyang, Youxian, Ningxiang, and Hengnan counties over a more than 100,000 mu area. Individual other counties have from 30,000 to 100,000 mu. The smallest rapeseed area is in the west where each county has fewer than 20,000 mu. Yields per mu are fairly high in nine counties including Xiangxiang and Liuyang, as well as in Xinshao, Shaodong, Shuangfeng, and Pingjiang, most of them being better than 100 jin per mu. In other vast areas, yields range from 70 to 80 jin per mu. This region's cotton yields per unit of area are not only lower than in the northern Hunan agricultural region, but are also lower than in the western Hunan agricultural region. Reasons are as follows: This region is prone to lack of water and drought during summer and fall. In addition,

cottonfields are spread out, and during the summer and fall high temperature and very busy seasons, cotton and paddy rice often vie for water, for the labor force, and for fertilizer, which impairs cotton output. Thus, development of cotton production in this region requires both strengthening cottonfield capital construction and proper readjustment of crop patterns to help centralize production.

Rape is an overwintering crop. As a result of the very great fluctuations in temperature in this region at the onset of winter and the continuously overcast and rainy days with little sunshine during the beginning of spring, rape growth and development is impaired and output is inconsistent. Thus, varieties that are stable during the onset of winter, strong, and cold resistant should be selected to insure safe overwintering. Rape should also be sown as early as possible and transplanted early (transplanting best being done before 20 November) so as to control its flowering period during the end of February or early March to help increase the fruiting rate and increase yields. In addition, in order to assure high yields from a three crop system, varieties that can be sown late and ripen early should be selected.

Ramie is this region's principal hemp crop, but it is grown over a small and widely scattered area. Thus, it does not constitute a large proportion of cash crops. It is currently grown on a 16,700 mu area and is found mostly in five counties in eastern Hunan (Table 72).

Table 72. Ramie Development in the Whole Region and in Five Counties of Eastern Hunan

(a) 区 县		1965年			1971年			1975年			1979年		
		(k) 面积 (亩)	(l) 亩产 (斤)	(m) 总产 (担)	(k) 面积 (亩)	(l) 亩产 (斤)	(m) 总产 (担)	(k) 面积 (亩)	(l) 亩产 (斤)	(m) 总产 (担)	(k) 面积 (亩)	(l) 亩产 (斤)	(m) 总产 (担)
(b) 全区		42058	52	22035	17119	95	16356	13723	114	15681	16700	114	19000
(c) 其中	(d) 平江	1623	116	1888	1050	108	1137	950	129	1228	1100	209	2300
	(e) 浏阳	7531	27	2050	1620	69	1115	892	82	734	700	86	600
	(f) 醴陵	1200	40	482	331	85	281	103	93	96	100	100	100
	(g) 攸县	10911	41	4490	2099	130	2738	1449	136	1977	1300	138	1800
	(h) 茶陵	3902	123	4815	3424	153	5237	3358	160	5384	4100	159	6500
(i) 五县合计		25167	55	13725	8524	123	10508	6752	139	9419	7300	155	11300
(j) 五县占全区的比重(%)		59.4		62.3	49.8		64.2	49.2		60.2	43.7		59.5

Key:

a. Region and county
b. Whole region
c. Including
d. Pingjiang
e. Liuyang
f. Liling
g. Youxian
h. Chaling
i. Total for five counties
j. Five counties' percentage of whole region
k. Area (mu)
l. Yields per mu (jin)
m. Gross output (dan)

Several years ago quite a bit of the hemp growing area was converted to the growing of paddy, and both the ramie growing area and ramie output declined sharply. The 1975 growing area was two-thirds less than in 1965, and gross output fell 29 percent. The drop was greatest in Liuyang and Youxian counties, where the growing area declined 88 and 87 percent respectively, and output dropped 64 and 55 percent respectively. Revival and development has taken place in recent years.

Though production of mat grass takes up a very small percent of the cash crop growing area in this region, it holds a prominent position in the province as a whole. Not only is Qidong County the center for mat grass production in this region, but also a major production area for the province as a whole. This county uses 21,800 mu to grow mat grass, which is 62 percent of the mat grass growing area in the region, and it produces as much as 217,700 dan, which is 63 percent of the mat grass in the region. Mostly it is found in 10 communes along a line running through Hongqiao, Guanshan, and Guiyang communes to the south of Chengguan in the county. Frequently it accounts for 50 percent of the county's area sown and output, and as much as about 70 percent in some years.

Other cash crops grown in the region are not a large percentage of the provincial total, but the growing of peanuts, sugarcane, and flue-cured tobacco is concentrated in this region. Peanuts are grown mostly in the western part of the region in Lianyuan, Shaodong, and Shaoyang counties on an approximately 70,000 mu growing area in most years. This is between 35 and 40 percent of the area in the region, and output is between 40 and 45 percent of the total for the region. In 1979, Lianyuan County planted 23,200 mu to peanuts for an output of 45,600 dan, or yields of 197 jin per mu. It is the county in the region with the greatest peanut output and also the one with the highest yields per unit of area.

Third Section. Direction and Main Avenues of Development of Agricultural Production

In view of its natural conditions, development of this region's agricultural production must proceed under guidance of a program of "taking grain as the key link, with all-around development and appropriate centralization." The level of grain and hog production must be further raised so that more grain and hogs assist national construction. The region should also use the existing foundation to consolidate and increase tea and citrus production and to take firm hold on cotton yields per unit of area. It should strive to develop oil-bearing crops, hemp, vegetable production, and aquatic products, and make sensible arrangements for forestry and other agricultural sideline production. It should make major efforts in the operation of suburban nonstaple food production bases to satisfy needs of industrial and mining cities.

1. Further Comprehensive Control of Farmlands, Soil, Mountains, and Rivers To Lay a Foundation for Sustained Consistently High Yields

Practice has demonstrated that comprehensive control of farmlands, soil, mountains, and water is a project of vital and lasting importance for withstanding natural calamities and developing socialist agricultural production. It must be treated as a matter of paramount importance in agriculture.

Simultaneous with construction of water conservancy at the Shaoshan irrigation area project was an effort from beginning to end to bring under control farmland soil and mountain waters throughout the entire irrigation area, thereby laying a fine foundation for rational use of the irrigation area's soil resources and all-around development of agricultural production. As a result of several years' construction throughout the irrigation area, nearly 1 million mu of farmland in Xiangtan, Xiangxiang, Ningxiang, Wangcheng, and Shuangfeng counties that had long lacked water became farmland producing consistently high yields. Average grain yields rose from 480 jin per mu in 1965, before construction of the irrigation area, to 800 jin in 1970. Since 1973, yields have consistently exceeded 1,000 jin per mu. In addition, 15,000 mu of tea plantations have been developed; more than 50,000 mu of wasteland has been cleared for agriculture (including 4,000 mu of new paddyfields); and 100,000 mu have been afforested, and certain areas have grown into forests. Tea plantations have begun picking, and farming, forestry, animal husbandry, sideline occupations and fisheries, as well as water transportation and electric power generation have all developed substantially. Main actions taken were the following: Simultaneous with building water conservancy projects was the harnessing and use of existing farmlands and of downlands suitable for cultivation as dictated by the type and character of terrain, gradually nurturing the soil, and institution of garden style farming. Irrigation and drainage ditch systems were built as part of farmland water conservancy facilities, so that fields would not be inundated with floodwaters, mountain waters would not enter fields, fertilizer and water would not leave fields, irrigation water would not go from one field to another, ground water would be drained from fields, and soil, fertilizer, and temperature would be preserved so that crops would grow and develop.

Barren mountains and sparse woods were afforested and closed off so forests could grow, and erosion was brought under control. In places where erosion was serious, a combination of engineering and biological measures were used to hold silt on the mountains and greatly reduce erosion damage to production. It is obvious from the success gained at the Shaoshan irrigation area that comprehensive tackling of farmland soil and mountain waters is an important way in which both to transform nature and to develop large-scale socialist agriculture more, faster, better, and more economically.

During the past more than 20 years, the whole region has done a large amount of work in building water conservancy, improving the soil, and harnessing the mountains, with varying degrees of progress and achievements. Nevertheless, development remains unbalanced, and this hurts rapid increase in production. Thus, it is necessary to proceed from requirements for large-scale socialist agriculture to carry out a planned, step-by-step, comprehensive harnessing of farmland soil and mountain waters throughout the region. During the near future, it is necessary to strengthen actions in the following several regards:

(1) Improvement of Water Conservancy Conditions, and Expansion of Farmland Able To Guarantee a Harvest Despite Drought or Waterlogging

Today 83.6 percent of the paddyfield area is able to produce a harvest despite drought or waterlogging. This amounts to only 0.69 mu per capita of agricultural population. The other 16.4 percent has not reached the standard of being able to deliver a harvest despite drought or waterlogging (Figure 40), and more than 90 percent of drylands lack water conservancy facilities. Furthermore, development has been very uneven (Figure 37). In the Lianyuan-Shaoyang area, even though the farmland capable of delivering a crop despite drought or waterlogging is more than 80 percent of the total farmland area (as in Shaodong County), the population is large relative to the amount of farmland, farmland averaging only 0.5 mu per capita. In addition some water conservancy facilities have yet to meet design requirements. Consequently, continued strengthening of the building of water conservancy and expansion of the area that can deliver a crop despite drought or waterlogging remains an important way to do a good job of farmland capital construction.

(1) Active promotion of Qianjin Reservoir experiences; consolidation and improvement of the capabilities of existing water conservancy facilities; full tapping of potential; and expansion of the area benefited. As a result of many years of practice, the Qianjin Reservoir in Shuangfeng County has produced a body of fairly complete experiences in doing a good job of storing water, managing water, and using water for sustained increases in yields, and the irrigated area is 75 percent greater than originally designed. Since 1967, grain yields have been more than 1,000 jin per mu year after year. The major actions taken were as follows:

Building mountain ponds, reservoirs, and dammed rivers to the maximum extent possible within the irrigation area to store rain water in the irrigation area, to lift river water, and to bring ground water to the surface. This

fully tapped water resources and increased the amount of water stored, the building of reservoirs serving as a mainstay, with ponds and dammed rivers acting as a foundation in the "growing of a vine that bears fruit," and an irrigation and drainage network that operates smoothly. The quality of ditches was improved to reduce the amount of leakage to the maximum extent possible. Fixed quotas of water were supplied promptly to insure irrigation needs on the basis of the nature of the soil in cultivated fields, the kinds of crops grown and requirements for water during their growing period, and distribution of rainfall. Some places in the region, particularly places with many mountains and hills, might promote this experience and make full use of favorable topographical conditions to increase the building of mountain ponds and ditches around mountains, do a good job of equipping projects, and use existing water conservancy facilities to make the most of "growing a vine that bears fruit," show good performance in scientific management and use of water, and not only make the most of existing water conservancy facility capabilities, but also expand irrigation benefits. This would also play a definite role in eliminating dead spots that cannot be irrigated during drought.

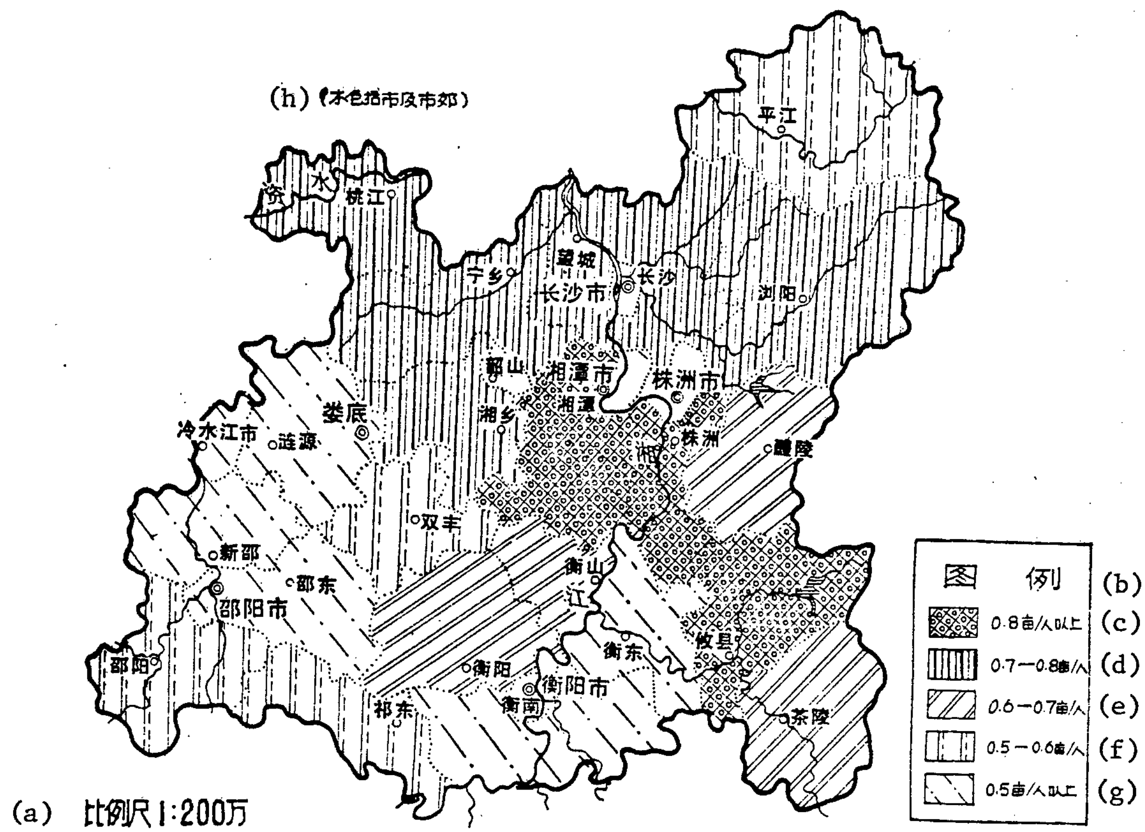


Figure 40. Map Showing Distribution of Paddyfields in the Central and Eastern Hunan Agricultural Region Able To Produce a Crop Despite Drought or Waterlogging

[Key on following page]

Key:

- a. Scale: 1:2,000,000
- b. Legend
- c. More than 0.8 mu per capita
- d. 0.7-0.8 mu per capita
- e. 0.6-0.7 mu per capita
- f. 0.5-0.6 mu per capita
- g. More than 0.5 mu per capita
- h. Not including cities and suburbs

(2) Increased building of water conservancy facilities and expansion of farmland able to deliver a guaranteed crop. Despite the copious rainfall in the region, seasonal distribution of rainfall is unbalanced. Thus it is necessary to do a good job of impounding surface water as well as to make full use of water resources in the Xiang Jiang, the Zi Shui, and their tributaries. The region has many downlands, and the region from Lianyuan to Shaoyang, in particular, does not greatly vary in height. The concentrated rainfall area is small, and not many places are suitable for the construction of large reservoirs. Most of the farmland not presently served by water conservancy projects is alluvial fields, fields along rivers, and alluvial branch fields [5897 1479 3944]. Future clearing of wasteland to expand the farmland area will also develop in the direction of the downlands; thus the main road for improving water conservancy conditions in this region must be active pursuit of a program of "taking the small scale as the key link," with more construction of mountain ponds and small reservoirs. At the same time, places having requisite conditions should be selected for the building of a group of mainstay projects in order to combine the large, the medium, and the small, make fullest use of surface water, and give maximum attention to development of ground water. Storage, extraction, and lifting of water should be linked for early realization of 1 mu per capita of farmland able to deliver a harvest despite drought or waterlogging to fundamentally solve the water conservancy problem in this region.

There are 23 sites in the region suitable for the building of new or expansion of old major large and medium size water conservancy projects (mostly medium size projects). Once these projects have been built, more than 5 million mu of farmland in the region will be better able to withstand drought. For example, once it has been built, the planned Liangshan water conservancy project (in southern Xinning County) will generate 13,400 kilowatts of electricity, and it will be able to irrigate 3.46 million mu of farmland and increase by 540,000 mu the amount of cultivated land (including 360,000 mu of wasteland that will be cleared to make fields) in 11 counties (and cities) to the east of the Zi Shui and in the hill region of Hengyang and Shaoyang northwest of the Xiang Jiang. It will also be possible to link it with other water conservancy facilities in the region to form a complete irrigation system. It will play an extremely major role in changing the drought situation in Hengyang and Shaoyang prefectures.

(3) Change of open ditches to covered ditches, and change from ditch irrigation to spray irrigation:

Today, most of the region's water conservancy and irrigation ditches are open ditches used for ditch irrigation. Since the period when water is needed during summer and fall is precisely the high temperature season when evaporation greatly exceeds the amount of rainfall, and since a certain amount of

evaporation and leakage of water occurs from the ditches that carry water, full effectiveness cannot be gained. Thus, simultaneous with improvement in the existing water conservancy ditch system must be a gradual change from open ditches to covered ditches, and a change from ditch irrigation to spray irrigation on the basis of crop growth needs, thereby reducing the amount of evaporation and leakage of water to achieve rational use and conservation of water.

(2) Improvement of Field Soil and Nurturing the Soil

(1) Major actions in nurturing soil and improving paddyfields: A soil survey conducted in Liuyang County during the past several years shows the following: The main factor preventing increased yields from paddyfield soil today is increase in the ground water table, with an increase in the percentage of paddyfields exhibiting a ferrous reaction. Quick acting nitrogen, phosphate, and potash is everywhere insufficient. The cultivated horizon of the soil is shallow, and the soil tends to be heavy clay or overly sandy. Thus, the following is necessary: (1) Increased use of organic fertilizer, growing of green manure, promotion of the "three nurtures of fields" (i.e., growing green manure so the fields nurture the fields, collecting barnyard manure so that livestock serve to nurture the fields, and collecting mud fertilizer so that compost pits nurture the fields), steady increase in the soil's organic content, increase of the soil's granular structure, and promotion of sustained high crop yields. After many years of increasing organic matter to hasten soil maturation on 1,006 mu of paddyfields at the Hengyang Prefecture Institute of Agricultural Sciences, paddy yields increased from 430 jin per mu in 1951 to 1,270 jin in 1966, were higher than 1,600 jin in 1973, and reached 1,770 jin in 1976. (2) Digging deep drainage ditches to lower the ground water table and get rid of cold waterlogging water and toxic mineral water so that the soil's water, fertility, air, and heat are transformed to help crop growth. (3) Institution of a rational system of crop rotation with fall plowing and winter sowing the better to link soil use and soil nurture. Proper deepening of the cultivated horizon and steady increase in fertility. (4) Mixing in of sand or clay to readjust the sand to clay ratio and improve soil quality so that the soil has better ability to retain water, to maintain temperature, to be ventilated, and to absorb heat.

(2) Major actions for nurturing the soil and improving drylands: Most of the drylands soil in this region has developed from red soil and purple soil, and most of it is found on slopes where water, soil, and fertilizer easily run off causing barren soil. Measurements taken by units concerned of reclaimed red soil slopes with a 17 degree gradient show more than 5,000 jin of soil per mu is washed away annually, with large quantities of organic matter and nutrients being carried off in the water. In view of this, the main actions for improving soil are as follows: (1) Building terraced fields and terraced land so that flat cultivated land takes the place of sloped cultivated land to cut down on surface runoff and present scouring of the soil in order to conserve water, soil, and fertilizer. (2) Deep plowing to nurture a thick mature soil horizon to help the soil hold water and conserve water so that the crops' root systems can spread out. (3) Increased fertilization with

organic fertilizer and intercropping of green manure to increase the soil's organic matter and increase soil nutrients. (4) Appropriately apply chemical fertilizer, replenish the soil's nutrients. (5) Open up water sources, increase irrigation facilities, and heighten the soil's capability to resist drought.

(3) Development of hill areas requires rational crop patterns plus a combination of soil improvement, conservation of water and soil, and afforestation.

Hill slopes are steep throughout the region, and thickness of the soil layer and extent of vegetation cover varies. General methods must be suited to specific circumstances to use hillsides in a rational way, with standards set for different slopes. (1) Places having a gradient of less than 15 degrees may develop hillsides for cultivated land. They may make a change to paddyfields where water for irrigation exists, and nurture the soil. (2) On slopes with a 15-25 degree gradient terraced fields or terraced land should be built to prevent scouring by soil and water. Economic forests and crop bases may also be built for the growing of tea, fruit trees, tea oil, and some cash crops. (3) In hill and low mountain areas with a gradient greater than 25 degrees the land should be afforested. Places having a thick soil layer may plant economic woods containing tea oil plants and nan bamboo. Where the soil layer is thin, timber forests, firewood forests, fertilizer forests, fodder forests, and forests that conserve soil and water should be grown. Mountains should be closed off so the forests can develop in order to conserve soil and water as well as to solve the fairly severe shortage in some areas of the "four materials" (timber, fuel, fodder, and fertilizer).

2. Expansion of Fertilizer Sources and Development of Hog Raising in Order To Provide More Organic Fertilizer for Agricultural Use

Fertilizer is plant food. Improvement in farm crop yields per unit of area and increase in the multiple cropping index within the region (such as promotion of a triple-cropping system), have posed ever increasing requirements for fertilizer. A 1974 survey of 17 early paddy production units and 10 late paddy production units conducted by the Xiangtan Prefecture Agriculture Bureau (Table 73) showed a need for increased fertilization to get high yields. In 1979, the average amount of fertilizer used throughout the region was 170 jin per mu of cultivated land of which 97 jin was nitrogenous fertilizer. For each mu of land, 0.91 hogs were raised, and the green manure area was about 70 percent of the paddyfield area; however, yields averaged only about 20 dan per mu. This was not enough fertilizer. Therefore, a buildup of fertilizer and increase in the amount of fertilization is an important way in which to win all-around yield increases. It is necessary to increase the amount of chemical fertilizer used while at the same time broadening the sources of manure through vigorous development of hog raising and accumulation of manure, and finding other sources of manure as well.

Table 73. Survey of Amount of Fertilization Per Mu for Double Crop Paddy

(a) 双季稻面积 (亩)	(b) 平均亩产稻谷 (斤)	(c) 肥料种类						(j) 平均每亩养猪 (头)
		(d) 绿肥鲜草 (担)	(e) 土杂肥 (担)	(f) 人畜粪 (担)	(g) 灰肥 (担)	(h) 氮素化肥 (折合碳氨标准) (斤)	(i) 磷肥 (斤)	
(k) 17个单位的早稻 (共5183亩)	949	30	94	21	24	50.2	11	1.4
(l) 10个单位的晚稻 (共944.4亩)	939.1		78	13	10	58.5	55	2.2

Key:

a. Double crop paddy area (mu)
b. Average paddy yields per mu (jin)
c. Kinds of fertilizer
d. Green manure and fresh grass (dan)
e. Mud fertilizer (dan)
f. Human and animal dung (dan)
g. Ash fertilizer (dan)
h. Nitrogenous chemical fertilizer (converted to standard ammonium carbonate) (jin)
i. Phosphate fertilizer (jin)
j. Average number of hogs raised per mu (head)
k. Early paddy in 17 units (a total of 5,183 mu)
l. Late paddy in 10 units (a total of 944.4 mu)

(1) Active development of hog raising, increase in number of hogs fed throughout the year, and guaranteeing crop fertilizer needs.

Though a substantial number of hogs are grown throughout the region at the present time, the goal of "1 mu, 1 hog" has yet to be reached. The number of hogs in inventory is relatively small at only 0.49 head per mu, a number that cannot supply crop fertilizer needs promptly. In order to be able to supply crops with adequate organic fertilizer, the number of hogs being raised will have to be increased to the point that the number in inventory is maintained at between 1 and 1.5 head per mu if crop fertilizer needs in all seasons are to be satisfied.

(2) Increase in green manure per unit of area. Green manure is a major source of fertilizer for early paddy production in this region; however, quite a few communes and brigades have yet to meet the requirement of 1 mu of green manure for high yields from 1 mu of early paddy. With expansion of the three crop farming area, the area devoted to the growing of green manure will correspondingly decline; thus rapid increase in green manure yields per unit will become even more important. According to the experiences of communes and brigades that have produced more than 5,000 jin per mu of fresh grass, of paramount importance is proper increase in the amount sown, the digging of deep ditches to drain away water, application of phosphate fertilizer, and proper side dressings of fertilizer so that small amounts of fertilizer help along the large applications of fertilizer.

Experiences with high yields of green manure should be actively promoted to achieve 1 mu of green manure to fertilize between 2 and 3 mu of fields.

(3) Full use of water surfaces to develop aquatic fertilizer. If ponds and streams are used to grow water hyacinths, water cabbage, and althermanthera philoxeroides, not only will they provide a direct source of fertilizer, but they will supply fodder for hogs and the production of hog manure. Experiences outside the region show that for every mu of water hyacinths, water cabbage, or althermanthera philoxeroides grown, the base fertilizer needs of 5 mu of late paddyfields can be met, and the green fodder needs of 15 head of hogs can be supplied.

In addition, everywhere in the region are numerous raw materials for the production of humic acid fertilizer. Full use of these resources for large scale making of humic acid fertilizer is also an important way in which this region can increase its source of fertilizer.

Collecting fertilizer, making fertilizer, conserving fertilizer, and spreading fertilizer are four major interdependent links in solving the fertilizer problem. None may be omitted. For this reason, once much fertilizer is accumulated, quality should be upgraded, and increasing attention should be given conservation and rational application of fertilizer.

3. Proper Expansion of Rotational Cropping of Rice-Rice-Rape, Rice-Rice-Fodders (or Rice and Fodder Including Pulse Fodder, Corn and Soybeans Used as Fodder, or Gaoliang Used as Fodder), and Rice-Rice-Green Manure

Suitable expansion of the rotational growing of rice-rice-rape and rice-rice-green manure, and a small amount of trial rotation of rice-rape-rice, and fodder plus double cropped rice. The advantages of these methods are as follows: First, outputs of grain, meat, and oil may be increased. Second, they help link grain and oil, help link farming and animal husbandry, and help link use of the soil and nurture of the soil. They can gradually change the longstanding situation in the province of it not being economically worthwhile to use rice with its fairly low protein content as livestock feed, using instead oil cake, corn, gaoliang, bean residues, and bean cake, which are of high food value as livestock feed, to help advance development of the livestock industry. Development of the livestock industry can, in turn, help mankind with the problem of being unable to use stalks, stems, leaves, and husks directly, having livestock convert them into meat, milk, hides, and hair, and obtain a large quantity of organic fertilizer as well. It can also avoid the drawback of soil gleying to which the growing of double crops of rice and green manure gives rise.

4. Efforts To Create Conditions for Gradual Mechanization of Agriculture

The pace of progress in agricultural mechanization has quickened over what it had formerly been. For example, the total number of tractors in 1975 was 83.4 percent larger than in 1973, and total horsepower increased 57.3 percent, including an almost doubling in Youxian and Shaodong counties. In addition, varying degrees of development were scored in the mechanization or

semi-mechanization of hauling, drainage and irrigation, processing of agricultural sideline products, and plant protection. By 1979, mechanized power used in agriculture throughout the region had increased to 2,413,700 horsepower, including 30,700 tractors with a horsepower of 457,600 horsepower (including 24,900 hand tractors with 254,000 horsepower), a 1.3 and 1.7 fold respective increase over 1975. In the field of farm machinery repair, each county set up farm machinery repair plants. Numerous communes and brigades started to operate farm machinery stations for the formation of a farm machinery building and repair network. Not only were they able to repair all sorts of farm machinery and equipment, but they were also able to build paddyfield machine plowing boats suited to fairly small areas, creating fine conditions for hastening the mechanized farming of paddyfields. In addition, some counties, communes, and production brigades substantially mechanized or semi-mechanized threshing, processing of agricultural sideline products, plant protection, and long distance hauling, and they also made advances in the mechanization of drainage and irrigation. However, the level of mechanization for the region as a whole is not high, and development is uneven (Table 74).

Table 74. Statistical Table on 1979 Level of Mechanized Farming for the Region as a Whole and for Four Counties

	(a) 项目	(b) 农用机械总动力		(c) 其中耕作机械(大中、小拖，机耕、机滚船)			
		(d) 合计 (马力)	(e) 平均每马力负担耕地 (亩)	(f) 合计 (台/马力)	(g) 平均每马力负担耕地面积 (亩)	(h) 实际机耕(耙) (i) 面积 (万亩)	(j) 占耕地面积 (%)
(k)	全区	241.37万	6.9	55,615/584,933	28.3	494.37	29.8
(l)	攸县	120,200	5.6	3,763/38,506	17.5	34.91	51.7
(m)	邵阳	67,000	10.5	637/9,518	74.0	2.61	3.7
(n)	宁乡	113,900	10.5	3,299/32,200	37.3	44.11	36.7
(o)	衡南	126,000	7.9	2,422/27,112	36.5	15.06	15.2

Key:
- a. Particulars
- b. Total machine power used in agriculture
- c. Including machine tillage (large, medium, and small tractors, machine cultivators, and power boats)
- d. Total (horsepower)
- e. Average amount of cultivated land per horsepower (mu)
- f. Total (numbers of equipment/horsepower)
- g. Average amount of cultivated land area per horsepower (mu)
- h. Actual mechanized plowing (or harrowing)
- i. Area (10,000 mu)
- j. Percent of cultivated land area (%)
- k. Whole region
- l. Youxian County
- m. Shaoyang County
- n. Ningxiang County
- o. Hengnan County

The whole region's cultivated land area per average horsepower of machine tillage is still fairly large, and the actual machine-cultivated area is only 29.8 percent of the total cultivated land area. Youxian and Shaoyang counties are at opposite ends of the scale, and a gap exists between Hengnan and Ningxiang counties as well. Thus, promotion of balanced development must go hand in hand with development of agricultural mechanization.

In order to bring about gradual agricultural mechanization of the region, a policy of "taking regions as the key link in farm machine manufacture, taking medium and small farm machines as the key link, and taking farm machinery purchases by the collective economy as the key link" must be followed, and the principle of "taking the needs of agriculture as most pressing, most outstanding results in increased yields, and maximum benefit in reducing the strenuousness of labor" must be used. The region's natural conditions must be linked to the nature of production, and research and development of various kinds of farm machines suited to rice, tea, and hog production must be accelerated: (1) Virtually the entire region has instituted the growing of two crops of rice, and this is also a region that has emphasized the growing of hybrid late rice. During the "double rush" season [the two times each year when one crop must be harvested while another is being planted], competition for time and labor is particularly prominent. Thus, further improvement, research and development, and promotion of harvesting and transplanting machines play an important role in winning bumper harvests from double cropping of rice. (2) Tea plantations have developed rapidly in the region, and the growing of both grain and tea has placed conflicting demands on the workforce. Thus, research, development, and promotion of tea picking and tea processing machinery is one key to the promotion of both grain and tea production. (3) This region's level of production centering around grain and hogs is fairly high, and grain and hog production complement each other. They depend on development of the mechanization of animal husbandry, and manufacture and spread of livestock feed processing machinery is particularly important. (4) Areas of economic diversification have gradually increased and spread, and the demand for multiple purpose machines is also fairly urgent. There is need to strengthen research, development, and promotion of farm machines and equipment that can be used in multiple ways.

5. Good Operation of Commune and Brigade Enterprises To Advance Development of Agriculture

Commune and brigade enterprises have developed very greatly during the past several years. Figured in terms of average for the agricultural population, commune and brigade enterprise earnings for the region in 1979 were 87.70 yuan per capita, and gross income was approximately 52.1 percent of the total for the province as a whole, placing it first among the province's four major agricultural regions. Cities and counties in which earnings from commune and brigade enterprises totaled more than 40 percent of the total derived from production teams, production brigades, and communes included Changsha, Xiangtan, Zhuzhou, Hengyang, Shaoyang, Lengshuijiang, and Shudi cities (and suburbs), and Wangcheng, Liling, Shaodong, and Lianyuan counties. In addition to six of the cities (or suburbs) in which earnings from commune and brigade operated enterprises reached between 51 and 68 percent of total

earnings, Wangcheng County was most outstanding with such earnings amounting to 53 percent of the total from the tri-level commune organization. Total earnings from commune and brigade enterprises in Liuyang and Shaodong counties were more than 100 million yuan. Lujiang Commune in Liling County, and Jingang Commune in Liuyang County had earnings of almost 10 million yuan from commune enterprises. Secondly, this region's commune and brigade enterprises are involved in a fairly large number of sectors, and their operations are fairly broad in scope. In addition to the farming industry and the breeding industry in agriculture, making of chemical fertilizer and pesticides, manufacture and repair of farm machines, making of electro-mechanical devices used in agriculture, and processing of agricultural sideline products, all of which directly serve agriculture, it is also necessary to suit general methods to specific circumstances to set up excavation, building materials, ceramic and porcelain, embroidering, firecracker, and hauling companies, and to produce a certain quantity of processed raw materials and agricultural sideline products to supply the country's needs. For example, Liling County's porcelains, and Liuyang's firecrackers are renowned at home and abroad. The sale abroad of large quantities has increased the country's foreign exchange holdings. Development of commune and brigade enterprises has played a very great role in agricultural production, in strengthening the collective economy, and in hastening the modernization of agriculture manifested in the following three ways:

(1) Capital accumulation to set the stage for agricultural mechanization: Capital accumulations by commune and brigade enterprises are fairly concentrated and large in quantity. In addition to being used for the expansion of reproduction, this capital may also be used to do things that production teams lack the power to do, to buy large farm machines, and to build water conservancy projects. Commune and brigade enterprises in Shaodong County, for example, accumulated more than 30 million yuan over the years, one-third of which was used to buy additional farm machines and for farmland capital construction. Huju Commune in Chaling County used commune and brigade enterprise capital accumulations to build 23 water conservancy projects, 10 electric powered drainage and irrigation stations, one small hydropower station, and to buy two motor vehicles and 10 large and small tractors, as well as more than 500 threshing and agricultural sideline product processing machines. The farmland area able to insure a crop despite drought or waterlogging rose from the former 60 percent to 93 percent. Progress in agricultural modernization quickened, advancing production steadily in depth and in breadth.

(2) Production of some of the means of agricultural production to promote development of agricultural mechanization: All the communes and brigades in Shaodong County started to operate farm machinery plants and repair sites to form a fairly complete farm machinery repair and manufacturing network. In addition to being responsible for the repair of medium and small farm machinery and equipment, they produced more than 21 million parts of 14 different kinds of farm machines. Relying on its industry, in 1976, this same county organized commune-operated enterprises to participate in and build a diesel engine plant with an annual capacity to turn out 5,000 Model 175 diesel engines to provide power for farm machines. In addition,

Xiangtan, Liuyang, and Youxian counties produced some native pesticides, powdered phosphate, ammonium humic acid, and agricultural lime. This lightened the country's load and promoted development of production.

(3) Training of technical forces for agricultural mechanization: Statistics from 16 counties including Xiangtan, Liuyang, Liling, Youxian, Chaling, and Xiangxiang show almost 235,000 people in commune and brigade enterprises. As a result of their participation in enterprise production, the technical level of an overwhelming majority of commune members has been heightened greatly, and they have become a vital new force in the socialist building of rural villages.

In order to use effectively the favorable conditions this region has regarding a plentiful workforce and abundant resources, future development will have to be in the direction of consolidating development helpful to commune and brigade enterprises and helpful to increasing the level of agricultural production, thereby advancing development of agricultural production and setting the stage for agricultural mechanization. In order to do this, it is necessary to intensify work in the following several regards:

(1) Great efforts in the farming industry, the breeding industry, and small processing enterprises: Increased building of tea farms, fruit orchards, and forest farms linked to development of hill and mountain lands; solution to the conflict between rice and fish for water linked to the building of water conservancy, with operation of fishery farms. Development of hog raising farms linked to a buildup of fertilizer, with corresponding building of processing plants for agricultural byproducts and multiple use of bamboo, as well as building enterprises to make paper and plait rattan.

(2) Building a number of agricultural sideline production and processing bases to meet foreign trade needs: Selection of communes and brigades with a concentrated number of products of outstanding quality that have convenient transportation, and use of their existing foundation to operate a group of export commodity bases for agricultural sideline products such as tea bases in Liuyang and Pingjiang counties; kumquat bases in Liuyang County; seedless honey tangerine bases at Shaoyang City and at Cao City in Hengdong County; silkworm mulberry bases in Liuyang and Pingjiang counties; poultry bases for Sanhuang chickens in Liuyang County, and for Suhuai ducks in Youxian County; dried chili pepper bases at Dazhang, Sifen, and Hejiaqiao in Liling County, at Huangtuling and Pingyangmiao in Youxian County, at Fengqi in Liuyang County, and in some communes in Shaoyang County; dried ginger bases at Huju, Pingshui, and Lushui in Chaling County, at Liankuangao, Liangjiang, Shiyangkuang, and Laojuntan communes in Youxian County; day lily bud bases at some communes in Shaodong and Qidong counties; live hog bases at some communes in Ningxiang, Changsha, Zhuzhou, Hengnan, Hengyang, Xiangtan, and Xiangxiang counties, in the Baliao region of Liling County, at Yakuangpu and Shiyangkuang communes in Youxian County, and at Guankou Commune in Liuyang County; straw mat bases at some communes in Qidong County; fireworks bases at Dayao and Jingang in Liuyang County, and at 17 communes including Baitutan, and Pukou in Liling; and ceramic and porcelain bases at some communes in Liling County.

(3) Suiting general methods to specific circumstances to develop small mines: Small deposits of phosphate, sulfur, gypsum, and coal suitable for mining by communes and brigades are found in many parts of the region, and they can provide some raw materials needed for national construction.

(4) Full use of existing bases for active development of traditional light industries and handicraft industries: Examples include Hunan embroideries and Hunan flour from Changsha, pottery from Liling County, and firecrackers from Liuyang County; native paper from Youxian, Chaling, Liuyang, and Xiangxiang counties; grass mats from Qidong County, carved bamboo from Shaoyang County, bamboo ware from Taojiang County, and small hardware items from Shaodong County, all of which may be actively developed on the basis of society's needs, with attention being given to increase in colors, styles, and varieties, and improvement in product quality.

(5) Suburbs may operate processing enterprises centering around production of nonstaple food products: Full use of the "three wastes" [waste water, waste gas, and industrial residues] in the operation of processing plants to turn trash into treasure. Particularly cities such as Changsha, Xiangtan, Zhuzhou, Hengyang, and Shaoyang, in which plants and mines are fairly concentrated, can use commune and brigade equipment, capital and workforces to manufacture and process some spare parts and small products for large industrial plants.

Fourth Section. Distribution of Sub-Regions and Pattern of Bases

1. Delineation of Sub-Regions

This region may be divided into the following sub-regions on the basis of principles for delineating sub-regions in combination with the region's natural conditions and existing bases for agricultural production.

(1) Eastern Hunan Mountainland and Hill Grain and Forest Region

This region includes Pingjiang, Liuyang, Liling, Youxian, and Chaling counties.

The eastern Hunan-Jiangxi border is an ancient metamorphic rock system where the rocks are generally solid, and the terrain generally fairly high. The Lianyun Shan, the Dawei Shan, and the Wugong Shan alternate with the valleys of the Liuyang He, the Lu Shui and Mi Shui and are laid out like columns of flying wild geese in a semi-mountain, semi-hill region of alternating hills and valleys.

Cumulative temperatures in the region equal to or greater than 10°C reach 5,328°C-5,697°C, and annual temperature averages 16.9°C-17.9°C. Annual precipitation is 1,376 millimeters in Chaling and 1,476 millimeters in Pingjiang. Liuyang is one of the three heavy rainfall centers in the province, receiving more rainfall during July and August than any of the other sub-regions in central Hunan, Pingjiang receiving 245 millimeters and Chaling 246 millimeters.

The soil is largely red soil, and in mountainlands red and yellow soils are interspersed at an elevation above sea level of between 600 and 1,200 meters. Yellow brown soil is found at between 1,200 and 1,400 meters. Red soil is found in the western hill region. Paddy soil is found in basins and on terraces along both banks of rivers.

The region has a population of 3.71 million, 95 percent of which is a rural population. It is the area of the central Hunan region having the smallest urban and town population. It has 3.48 million mu of cultivated land. It produces grain and hogs and is characterized by intensive farming and high yields.

Forestry takes up 16.5 million mu within the region, or 68 percent of total land. There are 10,527,100 mu of forests, of which 5.85 million mu are timber forests. Timber reserves stand at 10.26 million cubic meters, and nan bamboo reserves at 97.24 million stalks. The tea oil area of individual counties in this region is more than 300,000 mu and totals 3.53 million mu. In 1975, tea oil yields averaged about 4 jin per mu, and a great potential exists for increased yields. The region has 1.76 million mu of sparse forestlands, 1.26 million mu of scrub forests, and 2.71 million mu of barren mountains and cut over lands. A combination of afforestation of watershed forests and water and soil conservation is necessary to hasten development of forestry.

The region has abundant mineral resources. Iron mines in Youxian and Chaling counties, phosphate mines in Liuyang, ceramic clay, gold, gypsum, and coal in Liling are found over wide areas. This region has a large number of traditional products that have a long history, and technical forces are fairly abundant. Liuyang's firecrackers, grass linen, and bean paste; Liling's porcelain; and native paper from Liuyang and Youxian are very well known. Liuyang's Sanhuang chickens, Youxian's Suhuai ducks, Liling's dried chili peppers, Chaling's fresh ginger and garlic, and Liuyang's kumquats are farm and livestock products that have been grown and developed over a long period of time. They are of high quality, and it makes sense for the foreign trade sector to plan this region as a comprehensive foreign trade base.

(2) The Changsha-Hengyang Hills Grain, Hog, and Suburban Agricultural Region

This region includes Changsha City, Zhuzhou City, Xiangtan City, eastern Xiangxiang and Ningxiang counties, Hengdong, Hengshan, Hengyang, and Hengnan counties plus Hengyang City, and Qidong County.

This region has broad river valleys and numerous gently sloping low hills. The mainstream of the Xiang Jiang cuts through the Hengyang, Zhuzhou, Xiangtan-Xiangxiang, and Changsha basins. The cultivated area is broad and farmland concentrated. The region has 8.31 million mu of cultivated land, 11 percent of which is drylands. Cultivated land averages 1.1 mu per capita of agricultural population, making this the sub-region with the highest per capita average in the central and eastern Hunan region.

This is one of the regions in the province with the most abundant heat. Average annual temperature is 17.9°C at Hengyang, 17.6°C at Zhuzhou, and 17.2°C at Changsha. Cumulative temperatures equal to or greater than 10°C reach 5,667°C at Hengyang, 5,634°C at Zhuzhou, and 5,449°C at Changsha. Temperatures during July and August are very high, mostly above 29°C. During July, the average daily temperature at Hengyang reaches 29.9°C, and during August, average daily temperature is 29.2°C. Changsha, Zhuzhou, and Hengyang have the highest absolute temperatures at more than 40°C. Annual rainfall is more than 1,300 millimeters, but during July and August, this region gets the least rain in the central and eastern Hunan region, with Hengyang receiving only 183 millimeters, Zhuzhou 217 millimeters, and Changsha less than 230 millimeters. During July and August, precipitation is slight but evaporation is great, the wet and hot seasons occurring in a very unbalanced pattern. However, thanks to the fairly great achievements scored through building of water conservancy projects, the percentage of cultivated land from which a crop can be guaranteed despite drought or waterlogging is large, and provides a foundation for agricultural production.

The soil is mostly red soil, which is characterized by acidity, lack of fertility, and a thin soil layer. The region has 4.31 million mu of barren mountains and cut over land, the most of any of the sub-regions of central and eastern Hunan. Sensible development of hill red soil is one of the important tasks in this region. Purple soil is found largely in Hengyang, Hengshan, Hengdong, and Hengnan counties. It contains plentiful phosphate,

percolates and ventilates well, and is suitable for the growing of pulse crops. However, it does not retain water well, and it erodes easily.

This region is a hub for north-south and east-west transportation in China south of the Chang Jiang; its industry is developed, and it has numerous cities. The region has a population of 9.29 million, 2.15 million of whom are city dwellers. This is 45 percent of the province's city and town population. With 23 percent of the region's total urban and town population, this sub-region has the largest urban and town population in the province, and it is also the sub-region in which agriculture is most highly developed in suburban areas.

This region is the most classic one in the province for agricultural intensivity and high yields resulting from linking grain and hog raising. It is the province's most important grain and hog base. The region's city and town population is proportionally large, though the interregion significance of its grain is not large, nevertheless, it plays a major role in the supply of grain and nonstaple foods to the industrial population in cities and towns within the region. Future industrial and urban development within the region will continue to rely on continued development of intensive agriculture linking grain and hogs and suburban agriculture within the region. This region will become a consolidated grain and nonstaple food base that is able to avoid transporting over long distances large quantities of grain, and fresh and live products (hogs, fish, vegetables, and fruits).

This region has 2,908,000 cubic meters of timber reserves, making it the sub-region in the province with the smallest timber reserves. In the granite rock region of the basins of the Zheng Shui, Juan Shui and Wei Shui, erosion is serious. Shuikoushan, Changsha, Xiangtan, Zhuzhou, and Hengyang along the banks of the Xiang Jiang are also sources of environmental pollution in the region. Serious attention should be given to planting water and soil conservation forests in the basins of the Zheng Shui, Juan Shui, and Wei Shui, and to the use of afforestation of industrial and mining areas along the Xiang Jiang with fairly highly resistant trees as environmental protection forests, with the linking of improvement of red soil hills and the greening of barren mountains and cut over lands to produce woodlands over a large area. A preserve area should be built for fish spawning and overwintering of fish between Guiyang and the mouth of the Lai Hai on the Xiang Jiang, and environmental protection work should be intensified in the cities and towns along the Xiang Jiang, particularly along the Xiang Jiang between Zhuzhou and Xiangtan.

(3) The Lianyuan-Shaoyang Grain and Breeding Horticultural Region

This region includes Lianyuan, Shuangfeng, and Shaodong in Lianyuan Prefecture, Shaoyang, Xinshao, and Shaoyang City in Shaoyang Prefecture, and Taojiang and Ningxiang counties in Yiyang Prefecture.

The topography of this region is fairly high, with Shaoyang City being 249 meters above sea level, more than double the elevation of Hengyang City at 103 meters above sea level. Shuangfeng is 101 meters above sea level,

versus 44 meters for Zhuzhou. Hills are widely found throughout the region and the landscape contains much limestone. Most precipitation that falls flows underground where ground water is plentiful. Temperatures in this region are lower than in the Changsha-Hengyang region. In Shaoyang City and in Shuangfeng, the annual average temperature is 17.1°C, and average daily temperature during July and August is also lower than in the Changsha-Hengyang region, mostly lower than 29°C. Cumulative temperatures equal to or greater than 10°C reach 5,334°C in Shaoyang City, and 5,369°C in Shuangfeng. Shaoyang City gets 1,339 millimeters of precipitation annually, and Shuangfeng gets 1,336 millimeters. During July and August the amount of rainfall is slightly more than in the Changsha-Hengyang region. However, because of the wide occurrence of limestone in this region, which makes for easy runoff of surface water, this region is a part of the province's infamous Hengyang-Shaoyang drought corridor. Despite very great achievements in the building of water conservancy in this region since the founding of the nation, there are still many dead spots lacking irrigation, and the region has a somewhat weaker water conservancy foundation than the Changsha-Hengyang region. Mature mother soil is mostly limestone, containing a substantial amount of calcium, which is prone to form into mud balls, and there is a large amount of yashi soil. The soil layer is thin, and paddyfields lack both organic matter and effective phosphate.

The region's population is 5.63 million, 10 percent of which are city and town inhabitants. The region has 4.53 million mu of cultivated land, 28 percent of it drylands, making it the sub-region in the central and eastern Hunan region with the greatest percentage of drylands. This plus the widespread occurrence of limestone in the region, the easy runoff of surface water, and the large population relative to cultivated land in the region is frequently related to the clearing of mountainlands to make dryland fields. Cultivated land averages 0.8 mu per capita, the smallest average per capita amount of cultivated land of any region in the whole province. Average per capita grain production is the lowest in central and eastern Hunan, grain production being largely for self-sufficiency.

This is a newly emerging industrial and mining area. In order to meet needs for the ever-increasing development of industry and steady growth of urban population within the region, it is necessary to make full use of the favorable basis within the region for intensive and high yield agriculture involving production of hogs and fish, to make transportation easier, and to continue to develop breeding industries. Even if a small amount of fodder has to be brought in from elsewhere, that would still be much more preferable than bringing in live poultry and livestock and fresh fish from outside the region.

Full use must be made of the favorable conditions that the plentiful workforce provides as a result of a large population relative to cultivated land, and the fine foundation for the production of cash crops such as fruit, tea, day lilies, lilies, dry chili peppers, fresh ginger, and flue-cured tobacco to develop horticultural industries. The region has a 510,000 mu tea plantation area with a very great potential for increased yields. Taojiang, Shuangfeng, Lianyuan, and western Ningxiang counties

are major tea bases in the province. Shaoyang City is one of the four major citrus growing areas of the province, and the growing of honey tangerines has developed rapidly in Lianyuan and Shaodong counties.

The region has a 1.1 million mu nan bamboo growing area with nan bamboo reserves of 135.34 million stalks. Continued development should be made from this foundation. Development of Shaoyang bamboo wicker ware in this region and of Yiyang wicker ware in a neighboring region depends mostly on bamboo raw materials from this region. Inasmuch as this region's industries and mines are well developed, serious attention should be given to afforestation to produce mine props.

2. Tentative Thoughts on Location of Bases

The region has 3.3 million mu of sparse forests, 2.36 million mu of bush forests, and 8.71 million mu of barren mountains and cut over land for a total of 14.37 million mu that is not yet being used in a sensible way. The population is large and the labor force plentiful. They provide favorable conditions for further rational use of the hills and mountainlands within the region and a rational production pattern. The following thoughts are provided on the location of bases in the region in view of the region's direction of development:

(1) Consolidation and Upgrading of Tea Production Bases, Primarily in the West Central Parts of the Region To Make the Region Into a Tea Producing Area for the Whole Province

This region currently accounts for about 40 percent of both the entire province's tea plantation area and output, and fairly numerous favorable conditions exist in west central parts of the region for tea production, most salient of which are the following: (1) More favorable natural conditions than in the southern sub-region. Hillsides slope gently; the area is large, and there are both good drainage conditions and no competition with grain for land. There is much acidic red soil with a pH of 4.4-6 suited to the growing of tea. Threat from summer and autumn drought is less than in the south. In particular, in Taojiang, Lianyuan, and Ningxiang, which are close to the center of much rainfall in Anhua County, and in Pingjiang and Liuyang counties, which are at the center of the area having much rainfall, the probability of more than 300 millimeters of rainfall during summer and fall is more than 50 percent, while it is less than 40 percent in the south. Annual relative humidity is also greater in the north than in the south, mostly above 80 percent while it is less than 80 percent in the south. The north with its high relative humidity is favorable for increasing tea quantity and quality. (2) Most places are accustomed to growing tea, and there are numerous high yield models and people with plenty of experience. Lianyuan County's tea farm and tea plantation of 1,130 mu, for example, produced yields averaging 302 jin per mu of dry tea in 1975. In addition many small area high yield tea groves produced yields of 500 jin per mu. The Provincial Tea Institute's experimental tea grove, for example, produced yields of 751.2 jin per mu in 1976, and quality of fresh leaves was also quite good, with 86.2 percent of them being grade three or higher. (3) A

definite basis already exists for tea production. In addition to Xinshao, Zhuzhou, and Xiangtan counties, each of which has a 20,000 to 30,000 mu tea growing area, some other counties have more than 40,000 mu. Commune and brigade tea farms are also fairly numerous, and acreage is fairly well concentrated in continuous tracts, making the spread of mechanized production convenient. (4) Fields are few relative to population, and apart from Changsha, Xiangtan, Zhuzhou, Youxian, Hengnan, and Zhuzhou [as published] counties with an average 1 mu per capita, all other counties have less than 1 mu. Xinshao, Shaodong, Shuangfeng, Lianyuan, and Pingjiang counties have less than 1 mu per capita. Workforces are plentiful, so there is fairly little conflict over workforces in growing tea and rice. However, summer and autumn drought in the west central area is bad for increased tea yields during summer and autumn. Furthermore, the gradient of some tea plantation slopes is more than 15 degrees, opening them to scouring from torrential rains. Thus, future expansion of and improvement of existing tea plantations will require the building of contoured fields, building terraced land, and building terraced fields for tea growing, doing deep plowing to improve the soil, increasing fertilization, and building water conservancy facilities to prevent erosion and the threat of summer and autumn drought and promote consistently high tea yields.

(2) South Fairly Suitable for Laying Out New Citrus Production Bases

Citrus has dominated this region's development of orchards. Fresh fruit production, principally the growing of citrus, not only satisfies the needs of the region's industrial and mining cities, but also helps exports. Opening of red soil hills to citrus groves can both fully tap the potential of soil resources, and also does not lead to competition for land with grain and other cash crops.

This region's citrus production consists principally of seedless honey tangerines, sweet oranges, red tangerines, and kumquats. Since kumquats are heat loving perennial fruit trees, they are easily damaged by low temperatures, and sweet oranges' weak tolerance of cold makes them prone to freezing. Consequently, expansion of this region's citrus products must rely mostly on seedless honey tangerines. Since Heng Shan and other low mountains in the south weaken cold currents from the north, the frequency of low temperatures there is less than in the north, and the south is safe for the overwintering of citrus trees. Therefore, citrus growing should be developed mostly in the south, with emphasis on development in the direction of "close planting, dwarf trees, and early ripening." This will both help mechanization of citrus orchards and help guard against cold weather. Even should serious cold damage occur, recovery can be quick, and most advantage can be taken of increased yields from individual plant communities (Table 75).

(3) Patterns for Cotton, Oil-Bearing Crops, Hemp Crops, Forests, and Other Crops

(1) Cotton: This region maintains production of a certain amount of cotton that not only provides the region's own needs, but also supplies some raw

materials to Changsha and Xiangtan textile mills. However, cotton production today is spread out over a wide area and yields per unit of area are low. Consequently, it will be necessary to adapt general methods to specific circumstances in readjustment of the cottonfield area so that cotton production is properly concentrated on continuous tracts, the better to strengthen technical guidance and carry out mechanized production to increase output.

Table 75. Frequency of Low Temperatures Around Changsha and Hengyang

(a) 县	(b) -8℃以下绝对最低温出现年代	(c) 频率 (次/年)	(d) 资料年代
(e) 长沙	1955年(-8.2℃), 1957年(-8.4℃) 1969年(-9.5℃), 1972年(-11.3℃)	1/6.25	1951—1975共25年 (j)
(f) 桃江	1957年(-9.6℃), 1960年(-9.4℃) 1969年(-11.4℃), 1972年(-13.3℃)	1/4.75	1957—1975共19年 (k)
(g) 双峰	1967年(-8.2℃), 1969年(-9.8℃) 1972年(-9.9℃)	1/6.33	1957—1975共19年
(h) 衡阳	1972年(-9.9℃)	1/25	1951—1975共25年
(i) 衡东	1972年(-10.3℃)	1/22	1954—1975共22年 (l)

Key:

a. County
b. Years of occurrence of a lowest absolute temperature below 8°C
c. Frequency (times per year)
d. Data years
e. Changsha
f. Taojiang
g. Shuangfeng
h. Hengyang
i. Hengdong
j. 25 years from 1951-1975
k. 19 years from 1957-1975
l. 22 years from 1954-1975

(2) Oil-bearing crops: This region's output of oil-bearing crops is generally fairly low. Rape is grown over a fairly wide area; however, neither yield per unit of area nor gross output has been high during the past 10 years, and the size of the growing areas has fluctuated. A small proportion of peanuts are grown. Rape is grown on a 6.62 million mu area throughout the region and is concentrated in the low mountain and high hill area of the eastern and southern part of the region, but output is not consistent. If output of oil-bearing crops is to be increased, it will be necessary to set up some consistently high yield bases to give impetus to development of oil-bearing crops throughout the region. Both the eastern and southern parts of the region would be fine as key areas for development of a combination of rape, peanut, and tea oil "three oil" bases. These parts of the region offer the following principal advantages: (1) A fair number of hills that have not yet been used, which can be further improved and used through development of "three oils." (2) Frequency of occurrence of the absolute lowest winter temperature (below -8°C) is less than in the west central and eastern parts of the region to the benefit of the safe overwintering of rape. (3) A certain foundation already exists for the production of "three oils."

Oil tea is already grown in Hengdong, Hengyang, and Shaoyang counties, and rape is already being grown in Hengyang and Hengnan, and account for a certain percentage of the whole region's output. In every area, quite a few continuously high yield models have emerged. For example, the Hengyang Prefecture Agricultural Institute produced peanut yields of 500 jin per mu, and experiments conducted during the past several years on over 400 mu of land at Hejia Production Brigade in Hengshan County using a rice-rice-rape triple-crop farming system have produced rape yields averaging 200 jin. Given the present foundation and a proper division of labor, the specific pattern to be used for growing the "three oils" could be mostly rape in Hengyang and Hengnan counties, and peanuts mostly in Hengnan and Qidong counties. Rape could be grown mostly in five counties of eastern Hunan and in Hengdong and Hengyang counties.

(3) Hemp: Hemp is an important raw material for industrial production, and during the past few years, in particular, it has seen rapid development for blended textile industries. The volume of demand for ramie has increased particularly greatly. For this reason, emphasis should be placed on ramie in this region's development of hemp, and the eastern sub-region of this region already has a foundation and fairly good conditions for growing it as follows: (1) Numerous places have been accustomed to growing it for a long time. The historically famous "Liuyang grass linen" was produced around Liuyang and Pingjiang where yields per unit of area are fairly high. (2) Numerous low downlands exist among the mountains of the region. Their gradient is small, and the soil layer is thick and not waterlogged making them suitable for the growing of hemp. However, organic matter is lacking in the soil. (3) Ample amount of heat, and an effective growing season that is longer than that of the lake region in northern Hunan. Forest cover is fairly great and moisture fairly high, suiting the region to increased yields from the first and second crops of hemp; however, drought frequently occurs during summer and fall posing a considerable threat to output from the third crop of hemp. During harvest season, ramie and grain compete for labor. Thus, more water conservancy construction, nurture of soil fertility and increase in the degree of agricultural mechanization holds important significance for development of ramie production. In Youxian and Chaling counties, in particular, the area suitable for reclamation in order to expand ramie production is fairly large and suitable for the building of a ramie production base.

(4) Hastening the greening of mountains and hills in an equitable distribution of forestry production: Mountainlands and hills in the region suitable for development of forestry production are fairly numerous, and their area is also fairly large. The mountainlands on the edge of eastern Hunan, for example, mostly lie in a northeast to southwest direction and extend to five counties in the east. The Hengshan mountain range in the central part of the province cuts across parts of Hengyang, Hengshan, and Xiangtan counties. The Jingzifeng mountainlands in the low mountains mountainland area go through Hengdong and Zhuzhou counties. The Baozhong Shan mountainlands cut to the north of the Lian Shui into Ningxiang, Xiangxiang, and Xiangtan counties. The Huangchao Shan and Longwang Shan pass to the south of the Lian Shui through Xiangxiang, Shuangfeng and Hengyang. In the west, the

Xuefeng Shan range extends into Taojiang, Lianyuan, Xinshao, and Shaoyang counties. In addition, in each county are found numerous dispersed high hills and low mountains, which provide favorable conditions for development of forestry production. However, up until the time of liberation, forests sustained continuous damage. After liberation, for one reason or another, and particularly because of the effects of extreme leftist ideology, forestry production did not develop rapidly. Forestlands in the whole area account for only 35.5 percent of the total area, and are mostly pine, Chinese fir, bamboo, and tea oil. Timber reserves are slightly more than 17.5 million cubic meters, or only 9.3 percent of the total for the province as a whole. Mostly they are in eastern mountain regions. In the far-flung hill regions, except for a small amount of afforested Chinese fir forests and some tea oil forests, most forests consist of sparse growths of stunted masson pine. The foundation for forestry is weak, and forest sideline products scant. Of course, forestry has developed fairly rapidly in some areas. Such has been the case in Zhuzhou County and in the Zhuting-Shiwan forest zone neighboring Hengdong County. Simultaneous with development of grain production since 1965 has been concerted continuous tract afforestation with Chinese fir and sassafras forests over a 200,000 mu area. Other forest trees cover a more than 50,000 mu area. Moreover, experience created through the "three deeps" in growing Chinese fir in the poor soil of the mountains and hills (comprehensive deep cultivation, suitably deep planting, and deep digging for tending), has played a remarkable role in hastening growth of young forests. However, in most areas today, forests mature slowly; they are scattered over a fairly wide area; there are numerous sparse forests, and the forest cover rate is low. Furthermore, 10 percent of the region's barren mountains suitable for growing forests await afforestation. For this reason, in the strengthening of afforestation work, not only can mountains and hills within the region be used to develop forestry production, but they can be effective in regulating air temperature and moisture in part of the region and in preventing water and soil erosion. For example, simultaneous temperature measurements taken in forested areas and unforested areas during the high temperature season at Lukuang Commune in Hengyang County showed 32°C in forested areas and 42°C in unforested areas, a difference of 10°C.

The future will require intensified care of existing forests, active supplemental plantings in sparse forests, closing of forests to nurture forest growth, and the transformation of mountainlands, as well as the making of continuous tract forests as an aid to administration and management. At the same time, forestry will have to be mechanized. In planning forestry production, given the characteristics of mountains and hills in each area, the existing foundation and growing conditions, the focus should be on old forest areas in the eastern mountains, with vigorous efforts to develop timber forest bases consisting largely of Chinese fir, but also developing tea oil and nan bamboo production. On the west central downlands, timber forests of mostly masson pine should be developed in conjunction with tea production and some development of firewood forests as well as water and soil conservation forests. The hills of the south should be used to develop mostly masson pine timber forests in conjunction with development of fruit tree and tea oil production.

3. Building of Suburban Nonstaple Food Production Bases That Produce Mostly Vegetables

All the suburbs in this region should be responsible for supplying nonstaple foods such as vegetables, pork, fish, poultry, eggs and milk and efforts should be made to build nonstaple food production bases in order to do this. However, the cultivated land area in most suburbs is fairly small, while the year-round requirements of cities for fresh vegetables steadily increases. Thus, while building various kinds of nonstaple food production bases, emphasis should be placed on raising the level of vegetable production, the better to meet the needs of urban masses for fresh vegetables.

In the production of vegetables, the present vegetable growing land should be used as a basis for tapping potential to the full, with good performance in intercropping, increase in varieties grown, and increase in yields per unit of area. In addition, readjustments should be made in the kinds of vegetables grown during spring and autumn, with proper arrangements made for overwintering vegetables and for summer and autumn vegetables. In addition, full use should be made of spring and autumn vegetable growing seasons to expand production of vegetables that can be stored so that vegetables from the plentiful season will be available for the scarce season so as to ameliorate the vegetable shortages of April and May and the autumn season. This should be done in conjunction with use of low hill slopes to build fruit orchard and livestock fodder bases, operation of modern hog raising farms, poultry raising farms, and milk cow farms, plus use of waste water to run fish farms. However, it is necessary to guard against poisoning of fish with the "three wastes" [waste gas, waste water, and industrial residues]. Suburbs should be built rapidly into modern nonstaple food production bases.

Chapter 5. South Hunan Agricultural Region

Most of southern Hunan is a mountain and hill region that lies between the area south of the Hengyang-Shaoyang hill basin and the five ranges. It includes Lingling, and Chenzhou prefectures as well as Changning and Qiyang counties in Hengyang Prefecture, and Lingxian County in Xiangtan Prefecture for a total of 720 communes in 25 counties (cities, or towns). The land area is approximately 72,800,800 mu (which converts to 48,500 square kilometers), or 22.9 percent of the province's total area. Population totals 9,653,000, or 18.48 percent of the province's total population, and 202 people per square kilometer. The agricultural population totals 8,572,600, and cultivated land totals 9,340,600 mu, or an average 1.07 mu per capita of agricultural population. This is one of the regions in the province that is sparsely populated and has a fairly small number of fields, but fairly widespread mountain forests.

Statistics show this region as having had 18.1 percent of the province's cultivated land area in 1979, and as having produced 17 percent of its grain, 60.16 percent of its flue-cured tobacco, 21 percent of its sugarcane, as having 28.47 percent of its forested area and 27.3 percent of its timber reserves, and as having produced 39.14 percent of its tea. Historically it has been a major forest and oil producing area in Hunan Province. In recent years, it has continuously developed to become an important region for the production of flue-cured tobacco and sugarcane.

South Hunan was one of the old revolutionary bases during the period of the second civil revolutionary war. During the time of the Long March, the Red Army crossed the five ranges region and sowed the seeds of revolution. During the War of Resistance Against Japan, the Eighth Route Army's southward advancing contingents that Chairman Mao had dispatched, established an anti-Japanese base in southeastern Hunan. Thus, further development and construction of south Hunan holds not only major economic significance but also important political significance.

Second Section. Agricultural Production Characteristics

Under the overall influence of the foregoing natural and socioeconomic conditions, agricultural production in this region became a combination of intermediate sub-tropical southern mountain and hill farming and forestry. This became an agricultural economic region characterized by all-around development of agriculture.

(1) Large Percentage of Land Used for Forestry and Soil Utilization Configured in Bands

In this region, forestry uses approximately 73 percent of the land area, and in mountain regions it is as much as more than 80 percent of the land area (e.g., 90 percent in Shuangpai County and 82 percent in Guidong County). In hills and in river valley flatland areas, it is less than 70 percent (61.2 percent in Laiyang County, for example). About 18 percent of total land area is used for farming, and even less in mountain regions where it is less than 15 percent (11.3 percent in Guidong County). In hill and flatland areas, the amount can go as high as more than 20 percent (27.1 percent in Laiyang County). (Table 88)

Table 88. Table Showing Structure of Land Use in South Hunan

	(a) 项目	(b) 面积 (万亩)	(c) 占全区土地面积的百分比 (%)
(d)	土地总面积	7280.08	100
(e)	1. 林业用地面积	4783.36	65.70
(f)	①有林地面积	3105.00	42.65
(g)	其中:用材林面积	1760.51	24.18
(h)	经济林面积	918.97	12.62
(i)	②稀残林及其林面积	895.66	12.30
(j)	③荒山迹地面积	1208.22	16.60
(k)	2. 农业(种植业)用地面积	1266.26	17.39
(l)	①耕地面积	934.06	12.83
(m)	其中:水田面积	756.41	10.39
(n)	旱土面积	177.65	2.44
(o)	②可垦荒地面积	332.2	4.56
(p)	3. 水面面积	302.3	4.15
(q)	4. 其它占地面积	928.16	12.75

Note: Figures for some forestlands include timber forests, economic forests, and other forest lands. Thus, the total of the forested area, sparse and remnant forests and other forest areas, and barren mountain and cut over areas is greater than the total amount of land used for forestry.

[Key on following page]

Key:

a. Particulars
b. Area (10,000 mu)
c. Percentage of total land area in region (%)
d. Total land area
e. 1. Total land area used for forestry
f. (1) Forested area
g. Including: Area used for timber forests
h. Area used for economic forests
i. (2) Sparse and remnant forests and other forest areas
j. (3) Barren mountain and cut over area
k. 2. Area used for farming
l. (1) Cultivated area
m. Including: Paddyfield area
n. Dryland area
o. (2) Reclaimable wasteland area
p. 3. Water surface area
q. 4. Other land area

Going from north to south within the region is the northern hill basin, the central Yangming Shan mountainlands, the central basin of the middle reaches of the Xiao and Chunling, as well as the southeastern and southern mountainland topographical components, which taken together with other natural elements form a general east-west elongation of the south-north natural geographical belt-like structure. As a result of the overall effects of natural and socioeconomic factors, the structure of land use in this region also shows a general north-south pattern with east-west elongation in four transverse belts as follows: the northern hill and basin grain and oil (tea oil) band; the Yangming Shan mountainland forest and grain belt; the central Xiao and Chun middle reaches basin grain and oil (tea oil) belt; and the southeast and southern forest and grain belt.

(1) Most of the land used for forests is found in the mountainland forest and grain belt. In the Yangming Shan and Tashan mountainland belt in the central area, and in the mountainland belt of the east and south, the terrain is somewhat precipitous; climate is warm and moist; and the soil is rather fertile suiting it very well for forest tree growth and making it one of the major forest zones in the whole province. Survey statistics show the entire region as having a 31.05 million mu forestland area, and mountainland belts of more than 75 percent. Approximately 80 percent of mountainlands are used for forestry, and in individual communes in the Yangming Shan mountainland belt in the central part of the region, as much as between 85 and 90 percent of mountainlands are used for forestry. In the southeast and the south, as much as 75 to 80 percent of mountainlands are also so used. The forest cover rate for mountainlands is usually more than 60 percent. In Shuangpai County and Lingxian County, it is more than 66 percent. In Jianghua, Zixing, and Lanshan counties, it is about 50 percent. In the north and in the central hill basin, the terrain is relatively low and flat. Transportation is convenient, and farming developed here fairly early. It has become an area in the region in which farming and economic forests are found. Less than 65 percent of the land is used for forestry. The forest

cover rate is less than 45 percent; in the northern hill basin, it is between 34 and 47 percent; and throughout the central part of the region, it is between 30 and 43 percent. Land used for forestry grows mostly economic forests such as tea oil trees. The whole area has a 9,189,000 mu economic forest area, and 70 percent of this area is concentrated in the aforementioned two hill basins.

(2) The reclamation index for hill areas is higher than for mountain areas. Agriculture first developed in the north of this region and spread south in a process of movement from low and flat land to mountainlands. In the north, the red rock hill basin is an integral part of the Hengyang and Shaoyang basins. Conditions here are similar to those in central Hunan. It was developed fairly early; population density is fairly high; the extent to which land is used for farming is fairly high; and the reclamation index averages approximately 20 percent (the reclamation index for the region as a whole is 13.7 percent), including more than 20 percent in Lingling and Dongan counties in the west, between 18 and 20 percent in Qiyang, Changning, and Laiyang counties, and 15 to 18 percent in Anren and Yongxing. In the central Xiao and Chun middle reaches hill basin, the reclamation index averages between 13 and 20 percent, the highest being more than 20 percent (34.6 percent in Jiahe County, and 24.4 percent in Chenzhou City). In the Yangming Shan mountainlands, the reclamation index declines to less than 10 percent (in Shuangpai County, it is only 2.7 percent), and in the southeast and southern mountainlands, it is only 5 to 12 percent (12 percent in Jiangyong County, between 7 and 10 percent in Jianghua County, and between 5 and 10 percent in Zixing, Rucheng, Guidong, and Lingxian counties). Changes in the structure of land utilization in this region's farming industry reflects the limitations that natural conditions impose on farming in mountainlands, making them places with a vast amount of land and sparse populations offering great potential in natural resources. Development of hill regions began fairly early, and their population is large while the fields are rather few. Soil resources potential is less than in mountain regions. According to the 1975 ratio between cultivated land area and agricultural population for the whole region, cultivated land averaged 1.19 mu per capita. It was about 1.0 throughout the north, between 1.2 and 1.3 mu in the central area (being only 0.9 mu in Xintian County alone), less than 1.0 mu in the Yangming Shan mountainlands, and between 1.2 and 1.4 mu in the southeastern and southern mountainlands.

(2) Taking Agriculture as the Main Link, Forestry Holding an Important Position

In the structure of the agricultural production sector of this region, farming holds an absolute leading position. In 1975, output value of the farming industry accounted for 69.6 percent of gross output value, and in the north and in the central hill basin, it was even higher at more than 70 percent. It was 80.8 percent in Anren County. In Laiyang, Lingling, Dongan, Daoxian, Jiahe and Xintian counties, it was more than 71 percent. In the Yangming Shan mountainlands and in the southeastern and southern mountainlands, it was less than 70 percent. In Shuangpai County, it was 53 percent, and in Guidong, Rucheng, Jianghua, and Lingxian counties, it ranged from 64 to 69 percent. (Table 89) This commanding position of farming in this region developed

gradually following liberation. Up until the time of liberation, because of backward farming techniques, the extensive nature of farming, and the low level of production of the farming industry, in some mountain regions, in most years the output value of farming was the same as for forestry. It was not until the early 1970's that the output value of farming gradually climbed to a fairly prominent position.

Table 89. Table Showing Structure of Agricultural Sector in Southern Hunan

(a) 年份	(b) 农业总产值占全省农业总产值的百分比(%)	(c) 农、林、牧、副、渔产值占全区农业总产值百分比(%)				
		农 (d) 业	林 (e) 业	牧 (f) 业	副 (g) 业	渔 (h) 业
1971年	17.54	67.3	8.8	7.9	11.8	1.3
1975年	13.91	69.6	5.8	11.9	10.4	0.9

Key:

a. Year
b. Gross output value of agriculture as a percent of gross output value of agriculture for the province as a whole
c. Output value of farming, forestry, animal husbandry, sideline occupations, and the fishing industry as a percentage of the gross output value of agriculture for the region as a whole
d. Farming
e. Forestry
f. Animal husbandry
g. Sideline occupations
h. Fishing industry

Forestry has always been a major part of this region's agricultural production. Historically, the output value of forestry in some counties and communes in this region amounted to between 40 and 50 percent of the gross output value of agriculture. In 1956, for example, output value of forestry in Jianghua County amounted to 40.7 percent of the county's gross output value from agriculture. In the forest areas of the eastern part of the county, output value of forestry amounted to 64.4 percent of gross output value from agriculture. In recent years, forestry output value has shown a steady trend toward decline. In 1971, the region's output value from forestry stood at 77 million yuan, which was 8.8 percent of the gross output value of agriculture. Only in Shuangpai and Jianghua counties was the output value of forestry relatively high at 18.9 percent for each of them. By 1975, forestry output value had fallen to 65 million yuan, which was only 5.8 percent of the gross output value of agriculture. Except for Shuangpai County, where it rose to 24 percent, all other counties exhibited a marked tendency toward decline. These circumstances are related to inconsistent output of products by hill basin areas and economic forests. In mountain regions, it has been mostly owing to a decline in resources in forest regions near water. Development of forest resources in deep mountain forest areas is slow. In addition, the level of mechanization of forest transportation is also low; the cost of felling forests has increased; a large amount of timber is wasted; and prices paid for forest products and timber are

overly low, all of which have occasioned slow development. Furthermore, a conflict between farming and forestry exists in some places, and emphasis on farming to the neglect of forestry has resulted in slow development of forestry production, and even a halt.

Following liberation, as other industries developed, livestock industry production centering around the raising of hogs also developed correspondingly in this region. By 1975 output value of the whole region's animal husbandry industry had reached 134 million yuan, which was 11.9 percent of the gross output value of agriculture. These were increases over 1971 of 65 million yuan and 4.9 percent respectively. The northern and the central hill basin area are the places in this region in which animal husbandry is fairly well developed. In Changning, Qiyang, Ningyuan, and Xintian counties, animal husbandry accounts for 17 percent of the gross output value of agriculture, and in Qiyang County it goes as high as 19.2 percent. Animal husbandry has developed slowly in mountainlands where the output value of animal husbandry accounts for less than 10 percent of the gross output value of agriculture. In Jianghua County, output value of the animal husbandry industry amounts to only 3.7 percent of the gross output value of agriculture. In 1975, the whole region raised 5,078,000 hogs, or 16.1 percent of the total for the whole province. This means an average of 0.6 hogs per capita, and the rate of removal from inventory was only 44 percent. Animal husbandry output value as a percentage of gross output value of agriculture was 2.6 percent less than the average for the province as a whole. The greatest problem in animal husbandry production in this region is the lack of diversification of animal husbandry, which is predominantly the raising of hogs. This has caused an increase in grain consumption, with people and hogs vying for grain. Conversely, the abundant coarse fodder available in mountain and hill regions cannot be fully and equitably used, and this has hampered full development of animal husbandry's potential.

Sideline occupations are also a major component of this region's agricultural production, though they have not developed rapidly. In 1975, output value of the whole region's sideline occupations accounted for only 10 percent of agricultural output value. Rucheng County was fairly high with 20.8 percent. In Chenzhou City and Yizhang County, it was about 17 percent.

In most years, output value of the fishing industry amounts to only between 1 and 3 percent of the gross output value of agriculture, and in recent years, the trend has been toward decline. In 1975, for example, the fishing industry percentage was 0.4 percent less than in 1971. The reason lies in a low water surface utilization rate. There are more than 600,000 mu of usable water surfaces throughout the region, but the utilization rate is only 40 percent, and aquatic product yields per unit of water surface area are low. Secondly, with increase in the amount of use of chemical fertilizers and pesticides, the traditional rearing of fish in rice paddies has all but disappeared, and this, no doubt, is one reason for the decline in the aquatic products breeding industry.

(3) Level of Grain Production Not High, But Development of Cash Crops Such as Flue-Cured Tobacco and Sugarcane Is Relatively Rapid

Grain production is the main sector of this region's farming industry. In 1975, the area sown to grain crops amounted to 70 percent of the total area sown to farm crops, and the output value of grain crops was more than 50 percent of the gross output value of agriculture and 64.4 percent of the output value of the farming industry, which was somewhat higher than the average for the province as a whole (51.8 percent). This included Anren, Lingling, and Dongan counties where it was higher than 70 percent, and Changning, Daoxian, Ningyuan, Xintian, Jiangyong, Lanshan, Linwu, Yizhang, Guidong, Zixing, Laiyang, and Lingxian counties where it was higher than 65 percent. Grain crops consist of paddy rice for the most part, and both area sown and gross output of paddy are about 80 percent of area sown and gross output of grain crops. (Table 90)

Historically, grain production in this region has been influenced by natural and social factors. For a long time it has been a grain-short region lacking self-sufficiency. Following liberation, grain production saw substantial development. By 1979, grain output for the whole region totaled 7.546 billion jin, a 214.7 percent increase over 1949 for a 3.9 percent average annual incremental increase. Yields averaged 907 jin per mu, which was an average output of 862 jin per capita of agricultural population. In 1979, the region provided the state with 1.229 billion jin of marketable grain, Lingling, Changning and Laiyang counties providing more than 100 million jin each, and Dongan, Chenxian, Anren, Qiyang, and Zixing counties providing upwards of 50 million jin each. Supply of marketable grain averaged 140 jin per capita. Today the region is substantially self-sufficient in grain and has a slight surplus.

It must be noted that grain production in this region has historically been extremely inconsistent. This has been reflected both in inconsistency from one year to another and in inconsistency from one area to another. In the 5-year period 1965-1970, gross grain output increased 137.04 percent, or an average 6.5 percent annually. In the 9-year period between 1970 and 1979, however, increase was only 142.32 percent, or an average 4 percent annual increase. As another example, in 1967 gross grain from Lingling Prefecture and 12 counties including Qiyang, Changning, and Lingxian increased 10.7 percent over the previous year, while in the same year, output fell 3.0 percent in 11 counties (or cities) of Chenzhou Prefecture. The main reason for such inconsistencies may be found in lack of rapid change in farmland production conditions, occasioning not very high capabilities for withstanding natural disasters.

In 1975, 878,000 mu of land in the region was sown to cash crops. This was 28.6 percent more than in 1971. Output value of cash crops accounted for 7.47 percent of the output value of farming. This included 22.2 percent for Chenzhou City, and upward of 13 percent for Xintian, Jiangyong, Jiahe, and Guiyang counties. Daoxian, Ningyuan, and Jianghua counties also accounted for approximately 9 percent. Staple cash crops include sugarcane, flue-cured tobacco, ramie, and peanuts. Production of sugarcane and flue-cured tobacco has been most rapid.

Table 90. Table Showing Structure of Various Kinds of Crops in Hunan Province in 1979

	(a) 播种面积 (万亩)	(b) 占各类作物播种面积的百分比(%)			
		(c) 占农作物总播种面积	(d) 占粮食作物播种面积	(e) 占经济作物播种面积	(f) 占其它作物播种面积
(g) 农作物总播种面积	2065.33	100			
(h) 一 粮食作物	1491.12	72.2	100		
(i) 1.稻谷	1231.80		82.6		
(j) 2.小麦	45.16		3.0		
(k) 3.薯类	113.97		7.7		
(l) 4.杂粮	61.70		4.1		
(m) 5.大豆	38.49		2.6		
(n) 二 经济作物	103.81	5.0		100	
(o) 1.棉花	17.92			17.3	
(p) 2.油料作物	33.79			32.5	
(q) 3.糖料作物	5.68			5.5	
(r) 4.烟叶	38.4			37.0	
(s) 5.麻类	1.49			1.4	
(t) 6.药材	3.11			3.0	
(u) 7.其它经济作物	3.42			3.3	
(v) 三 其它作物	470.40	22.8			100
(w) 绿肥	404.21				85.9

Note: This table is based on "Annual Statistical Report on the National Economy of Hunan Province" for 1979 from the Hunan Provincial Statistical Bureau.

Key:

a. Area sown (10,000 mu)
b. Percentage of area sown to all crops
c. Percentage of total area sown to farm crops
d. Percentage of area sown to grain crops
e. Percentage of area sown to cash crops
f. Percentage of area sown to other crops
g. Total area sown to farm crops
h. a. Grain crops
i. 1. Paddy rice
j. 2. Wheat
k. 3. Tubers
l. 4. Grains other than wheat and rice
m. 5. Soybeans
n. b. Cash crops
o. 1. Cotton
p. 2. Oil-bearing crops
q. 3. Sugar crops
r. 4. Tobacco
s. 5. Hemp
t. 6. Medicinal herbs
u. 7. Other cash crops
v. c. Other crops
w. Green manure

Sugarcane is a traditional cash crop of this region. However, past development was slow, mostly fruit cane having been produced with sugar cane occupying a not very important position. Following liberation, and particularly in recent years, cane production suddenly took off. In 1975, 84,400 mu were sown to sugarcane throughout the region. This was 9.6 percent of the area sown to cash crops, and 37.76 percent of the total sugarcane growing area of the province. Gross output of sugarcane was 3,082,000 dan, a 1,020 percent increase over 1949 and a 183 percent increase over 1970. During the period immediately following liberation, sugarcane yields averaged only about 2,600 jin per mu, and they were no more than 3,100 jin per mu in 1965. Introduction of superior varieties in recent years and adoption of advanced cultivation techniques have brought about substantial increase in yields per unit of area. In 1975, sugarcane yields for the whole region averaged 3,651 jin per mu (they rose further to 4,927 jin per mu in 1979). Shangguan Production Brigade in Shangguan Commune, Daoxian County averaged yields of more than 13,000 jin per mu. Daoxian, Yizhang and Qiyang counties in the southwest, south central, and northwestern parts of the province are the three principal sugarcane producing areas. (Table 91 and Figure 45)

Table 91. Status of Sugarcane Production in 1979 (Major Producing Counties)

(a) 县名	(b) 面积 (万亩)	(c) 产量 (万担)	(a) 县名	(b) 面积 (万亩)	(c) 产量 (万担)
(d) 郴县	0.40	17.09	(h) 道县	1.72	85.56
(e) 宜章	0.33	14.94	(i) 宁远	0.26	13.68
(f) 临武	0.26	11.02	(j) 江永	1.14	66.42
(g) 零陵	0.33	16.15	(k) 祁阳	0.71	37.19

Note: Each of the foregoing counties has machine-processed sugar refineries. Cane production in 1979 did not saturate refinery capacity.

Key:
- a. County
- b. Area (10,000 mu)
- c. Output (10,000 dan)
- d. Chenxian
- e. Yizhang
- f. Linwu
- g. Lingling
- h. Daoxian
- i. Ningyuan
- j. Jiangyong
- k. Qiyang

The region does not have a long history of flue-cured tobacco production, but development has been rather fast in recent years. As of 1979, the flue-cured tobacco growing area was 363,900 mu, or 35 percent of the region's total cash crop growing area and 57.8 percent of the area planted to flue-cured tobacco in the whole province. (Table 92) Gross output of flue-cured tobacco was 639,400 dan, or an average of 176 jin per mu. In Jianghua County, yields average better than 208 jin per mu. Flue-cured tobacco quality has risen very rapidly, with premium tobacco leaf production being higher than 10 percent in Jianghua and Guiyang counties. Jianghua County currently stands second in the country in the percentage of premium flue-cured tobacco leaf production, second only to Yongding County in Fujian Province. (Figure 46)

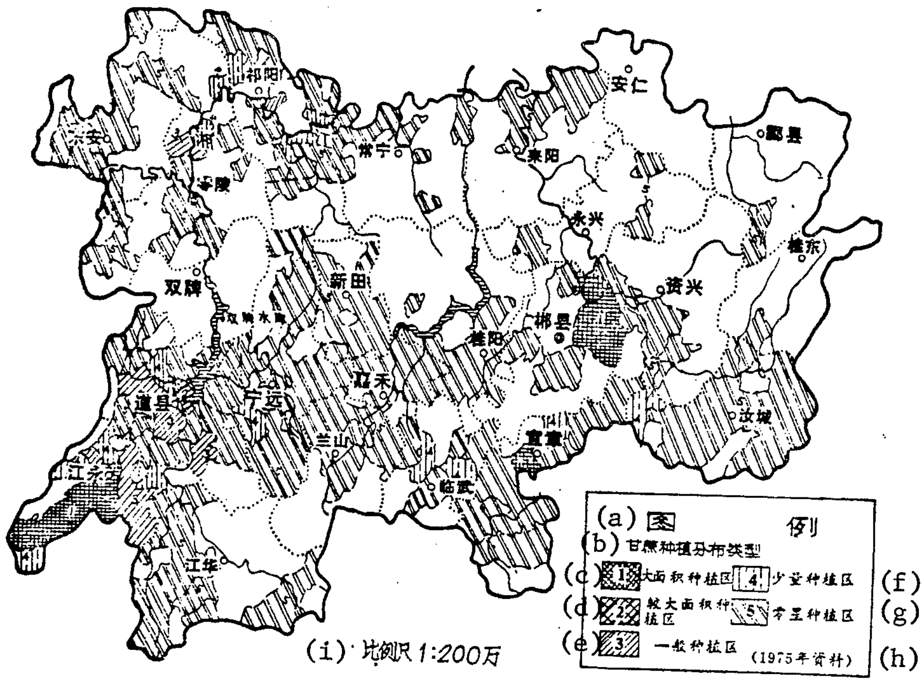


Figure 45. Map Showing Sugarcane Distribution in South Hunan Agricultural Region

Key:

a. Legend
b. Distribution of sugarcane growing
c. 1. Large area growing zone
d. 2. Fairly large area growing zone
e. 3. Ordinary growing zone
f. 4. Small quantity growing zone
g. 5. Scattered growing zone
h. 1975 data
i. Scale 1:2,000,000

Table 92. Status of Flue-Cured Tobacco Production, 1979 (Major Producing Counties)

县名 (a)	面积 (b) (万亩)	产量 (c) (万担)	县名 (a)	面积 (b) (万亩)	产量 (c) (万担)	县名 (a)	面积 (b) (万亩)	产量 (c) (万担)
(d) 桂阳	7.39	14.01	(i) 道县	2.71	4.53	(n) 嘉禾	1.02	1.57
(e) 新田	4.46	9.70	(j) 零陵	2.01	2.49	(o) 江永	0.96	1.44
(f) 宁远	4.20	8.22	(k) 郴县	1.13	1.64	(p) 东安	0.60	1.09
(g) 耒阳	3.30	4.81	(l) 安仁、蓝山	各1.06	1.55			
(h) 江华	3.09	6.43	(m) 永兴	1.04	1.42			

(q) 其余各县不足1万担。

Key:
- a. County
- b. Area (10,000 mu)
- c. Output (10,000 dan)
- d. Guiyang
- e. Xintian
- f. Ningyuan
- g. Laiyang
- h. Jianghua
- i. Daoxian
- j. Lingling
- k. Chenxian
- l. Anren, Lanshan
- m. Yongxing
- n. Jiahe
- o. Jiangyong
- p. Dongan
- q. Less than 10,000 dan for all other counties

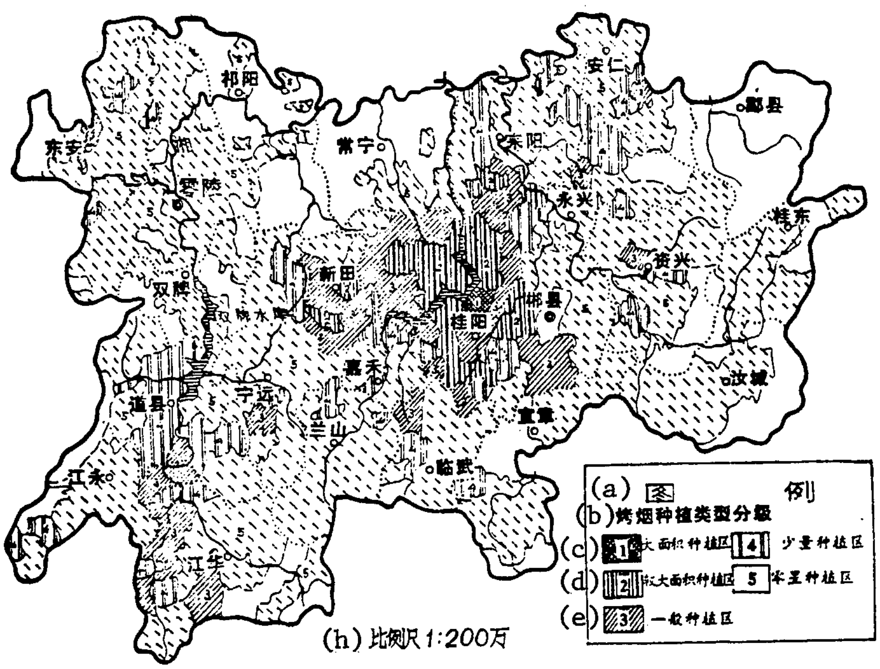


Figure 46. Map Showing Flue-Cured Tobacco Distribution in South Hunan Agricultural Region

[Key on following page]

Key:

a. Legend
b. Distribution of flue-cured tobacco growing
c. 1. Large area growing zone
d. 2. Fairly large area growing zone
e. 3. Ordinary growing zone
f. 4. Small quantity growing zone
g. 5. Scattered growing zone
h. Scale 1:2,000,000

Historically this region has been one of the province's major peanut growing areas. In most years the area planted to peanuts and peanut output amount to 30 and 35 percent respectively of the total for the province as a whole. As a result of the influence in recent years of lopsided emphasis on growing grain, the peanut growing area has declined. In 1971, the area sown to peanuts was 28.2 percent and output was 35.10 percent of the provincial total. In 1979, however, it accounted for only 21.89 percent of the area sown and 22.99 percent of provincial output. The major peanut producing area in the province is Daoxian County where the area sown to peanuts and year-in year-out output is about 15 and 20 percent of that for the whole region. In 1971, this county planted 31,100 mu to peanuts and had a gross output of 53,900 dan. Following Daoxian County are Lingling, Jiangyong, Ningyuan, Jianghua, Guiyang, and Jiahe counties, each of which grow about 10,000 mu of peanuts annually and have gross outputs of between 10,000 and 20,000 dan (Table 93) (Figure 48).

Table 93. Status of Peanut Production in 1979 in South Hunan Region

(a) 县名	(b) 面积 (万亩)	(c) 产量 (万担)	(a) 县名	(b) 面积 (万亩)	(c) 产量 (万担)	(a) 县名	(b) 面积 (万亩)	(c) 产量 (万担)
(d) 道县	2.1	3.28	(g) 零陵	1.11	1.50	(j) 嘉禾	0.84	1.10
(e) 宁远	1.35	1.83	(h) 桂阳	0.95	1.09	(k) 宜章	0.78	1.07
(f) 江永	1.34	1.92	(i) 江华	0.93	1.39	(l) 蓝山	0.59	0.98

Key:

a. County
b. Area (10,000 mu)
c. Output (10,000 dan)
d. Daoxian
e. Ningyuan
f. Jiangyong
g. Lingling
h. Guiyang
i. Jianghua
j. Jiahe
k. Yizhang
l. Lanshan

Ramie has a long history of cultivation in this region, but development has been slow. In most years the sown area and gross output are 18 and 17 percent respectively of the provincial total. In 1979, a 12,800 mu area of the region was sown to ramie for a gross output of 10,300 dan. Major producing areas are Jiahe, Changning, Yizhang, Laiyang, Guiyang, and Lanshan counties. Jiahe County accounts for about 50 percent of the area sown and the gross output of the region in most years, and it is one of the main ramie producing counties in the province.

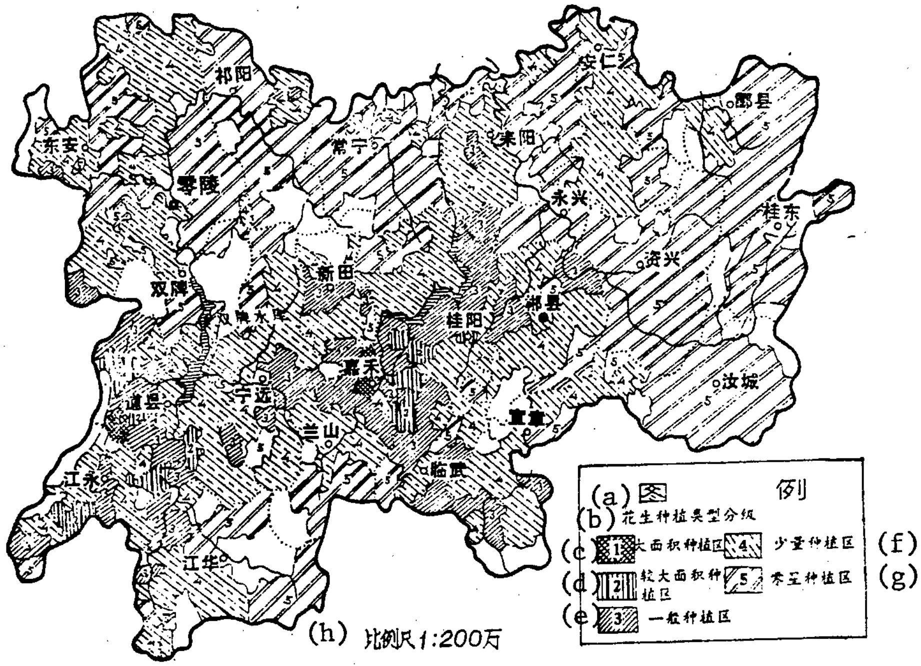


Figure 48. Map Showing Peanut Distribution in South Hunan Agricultural Region

Key:

a. Legend
b. Breakdown of peanut growing zones
c. 1. Large area growing zone
d. 2. Fairly large area growing zone
e. 3. Ordinary growing zone
f. 4. Small quantity growing zone
g. 5. Scattered growing zone
h. Scale 1:2,000,000

(4) Good Foundation for Forestry Production; High Degree of Marketability

The region's current forest timber reserves are approximately 51,106,000 cubic meters, or 27.3 percent of total timber reserves for the province as a whole. Zixing, Rucheng, and Lingxian each have timber reserves of more than 6 million cubic meters; Jianghua and Shuangpai counties each have timber reserves of more than 5 million cubic meters; and Yizhang, Lanshan, Jiangyong, and Qiyang counties each have timber reserves of more than 2 million cubic meters. Zixing, Rucheng, Lingxian, Jianghua, Shuangpai, and Yizhang counties are key forest regions of the province. Three of the 11 communes (or farms) in the province having timber reserves of more than 1 million cubic meters are located in this region. Communes (or farms) having timber reserves of more than 100,000 cubic meters number 108. Qingshigang Forest Farm in Lingxian has 2.59 million cubic meters of timber reserves, and Gaozeyuan Forest Farm in Jiangyong County as well as Mangshan Forest Farm in Yizhang County each have timber reserves of more than 1.7 million cubic meters. These are the communes (or farms) with the greatest

timber reserves in the whole province. This region has bamboo reserves totaling approximately 250 million stalks, which is 30 percent of bamboo reserves for the whole province. Ten of the 32 counties in the province having nan bamboo reserves totaling more than 10 million stalks are in this region. This includes Shuangpai County with nan bamboo reserves of more than 35 million stalks, Lingxian County with more than 20 million stalks, Laiyang, Dongan, Rucheng, and Zixing counties each of which has more than 15 million stalks, and Chenxian, Changning, and Lanshan counties, each of which has more than 10 million stalks.

Statistics show this region as having provided the state with an average of between 500,000 and 600,000 cubic meters of timber each year since liberation. This has been about 30 percent of the province's marketable timber. This region has annually provided between 2.1 and 2.5 million stalks of marketable bamboo. Over the past 30 years, it has provided the state with between 60 and 70 million stalks of marketable bamboo. Annual tea oil output ranges from 250,000 to 500,000 dan, or about 45 to 50 percent of the whole province's gross output of tea oil each year. In 1971, the region's gross tea oil output reached 523,500 dan (or 51.32 percent of the whole province's gross output of tea oil), making 1971 the year of greatest output since liberation. In most years, the region provides the state with between 150,000 and 200,000 dan of marketable tea oil, which is between 50 and 55 percent of all the tea oil that the state buys from the whole province. Laiyang County (with an annual tea oil production of between 50,000 and 80,000 dan), Changning and Yongxing counties (30,000 to 50,000 dan), and Lingling, Qiyang, Daoxian, and Chenxian counties (20,000 to 30,000 dan), all of which are in this region, are major tea oil producing counties in the province. Additionally, Dongan, Ningyuan, Lanshan, Zixing, and Lingxian counties annually produce about 10,000 dan of tea oil. This region has plentiful forest resources and a long history in forestry operations. The level of forestry economic development is fairly high. It has Shuangpai County where forestry predominates, and a large number of communes and brigades in which forestry predominates that also grow grain. About 12.3 percent of all communes in the region are devoted primarily to forestry. Not only does forestry hold an important position in this region's agricultural production, but this region is also a major base in the province for timber and forest sideline products.

The predominance of Chinese fir forests is a prominent feature of forestry in this region. Statistics show the Chinese fir forest area as amounting to 38.4 percent of the region's total forested area, with Chinese fir reserves accounting for 40 percent of timber reserves. The proportion of Chinese fir forests is highest in the Jianghua and Shuangpai forest regions in the Xiao Shui basin. Chinese fir forests in these two regions account for 48.2 and 74.1 percent of the total timber forest area, and reserves account for 57.8 and 74.2 percent of timber forest reserves. Secondly, forest growth has been fast. The growth rate for various kinds of forests has been between 4.0 and 4.6 percent, and the maximum annual growth rate reached 6.8 percent. Since liberation, steady increase has taken place in the level of scientific forestry among people in forest regions, and numerous advanced experiences have been gained in the growing of quick growing, high yield forest trees.

At the Taowei work area of Jianghua Forest Farm, 470,000 mu of Chinese fir forests were planted on the northwestern slope of Mengzhu Range. After more than 10 years of tending, there is an 80 percent canopy closure, and reserves average 15 cubic meters per mu. The maximum has been 32.7 cubic meters per mu.

This region's forestry has adhered to a program of development of walking on two legs. Simultaneous with development of state-owned forest farms, it went all out with commune and brigade forest farms. By 1975, the whole region was operating 5,039 commune and brigade collective forest farms over a land area of 8,462,200 mu of which 4,805,800 mu, or 13.3 percent of the forested area of the whole region, was forested. Since liberation, a total area of 15,488,800 mu in the region has been replanted to forests, and reserves now cover an 11,854,000 mu area, which is 76.4 percent of the re-afforested area. Since 1971, each person in Shuangpai County has afforested an average of 1 mu per capita, has tended 2.5 mu of young forests, and has produced 1 cubic meter of timber and 10 stalks of nan bamboo. The forested area was 16 percent larger in 1976 than in 1970; timber reserves increased 8 percent; and nan bamboo reserves increased 16 percent. Supplies to the state increased 30 percent for marketable timber and 100 percent for nan bamboo. Development of forestry production has given impetus to development of grain production. Grain yields for the whole province have averaged more than 800 jin per mu for many years in a row, and economic diversification has also developed considerably.

Third Section. Agricultural Regional Types and Agricultural Sub-Regions

(1) Agricultural Regional Types and Their Characteristics

This area's agricultural regional type has been formed through a long historical process of human development of the intermediate sub-tropical southern mountain and hill natural environment. This region may be divided into three primary types and 21 secondary types (Table 94 and Figure 49) following the principles of: 1) the relative identicalness of agricultural production conditions and production characteristics; 2) use of land utilization and the structure of the agricultural sector as guiding principles; and 3) maintenance of the integrity of communes.

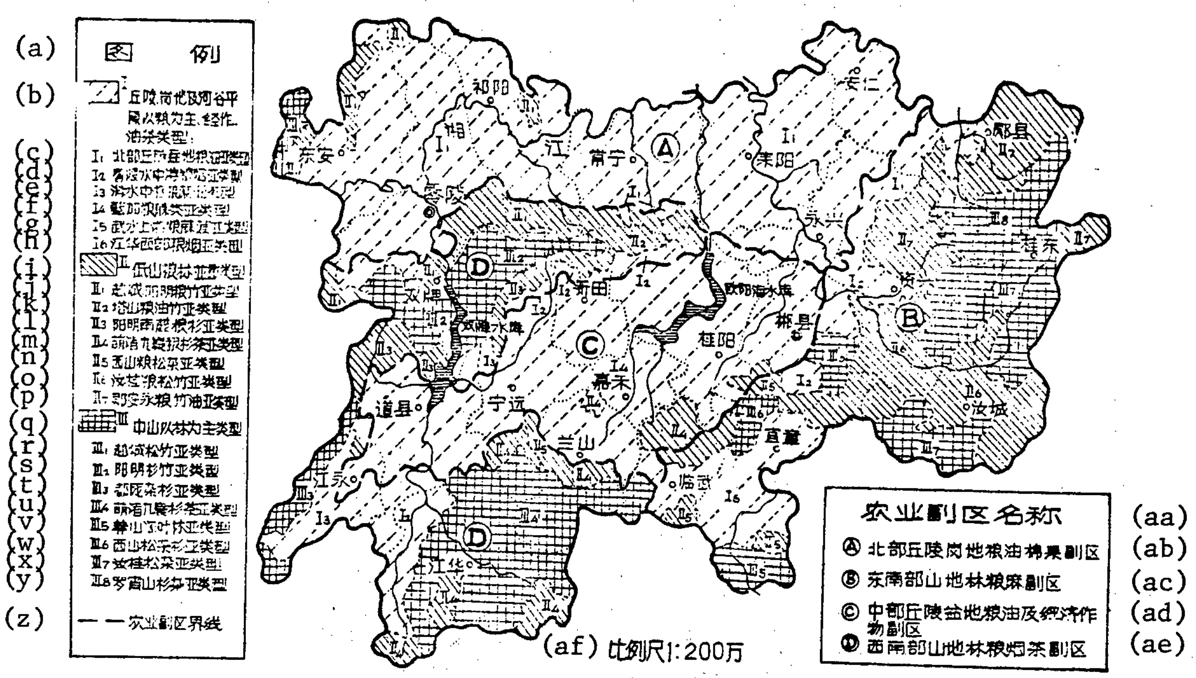


Figure 49. Map Showing South Hunan Agricultural Production Regional Types and Agricultural Sub-Areas

Key:

- a. Legend
- b. I. Hill, downland, and river valley plain type, where mostly grain, cash crops, and rape are grown
- c. I_1. Northern hill basin grain and oil sub-type
- d. I_2. Middle reaches of the Chunling Shui grain and tobacco sub-type
- e. I_3. Middle reaches of Xiao Shui grain and sugarcane sub-type
- f. I_4. Yanjia grain and hemp sub-type
- g. I_5. Upper reaches of the Wu Shui grain, hemp, and sugarcane sub-type
- h. I_6. Western Jianghua grain and tobacco sub-type
- i. II. Low mountain co-equal grain and forest type
- j. II_1. Yuecheng, Yangming grain and bamboo sub-type
- k. II_2. Tashan grain, oil, and bamboo sub-type

l. II_3. Yangming southern foothills grain and Chinese fir sub-type
m. II_4. Mengzhu, Jiuyi grain, Chinese fir, and tea sub-type
n. II_5. Xishan mixed grain and pine sub-type
o. II_6. Rugui grain, pine, and bamboo sub-type
p. II_7. Ling'anyong grain, bamboo, and oil sub-type
q. III. Primarily forest central mountain type
r. III_1. Yuecheng pine and bamboo sub-type
s. III_2. Yangming Chinese fir and bamboo sub-type
t. III_3. Dupang mixed Chinese fir sub-type
u. III_4. Mengzhu, Jiuyi Chinese fir and tea sub-type
v. III_5. Mangshan deciduous forest sub-type
w. III_6. Xishan mixed pine and Chinese fir sub-type
x. III_7. Rugui mixed pine sub-type
y. III_8. Luoxiaoshan mixed Chinese fir sub-type
z. Agricultural sub-region demarcation line
aa. Names of Agricultural Sub-Region
ab. A. Northern hill and downlands grain, oil, cotton, and fruit sub-region
ac. B. Southeast mountainland forest, grain, and hemp sub-region
ad. C. Central hill basin grain, oil, and cash crop sub-region
ae. D. Southwest mountainland forest, grain, tobacco, and tea sub-region
af. Scale: 1:200,000,000

I. Hill, Downlands, and River Valley Basin Grain, Oil, and Tea Type With Grain Predominating

This type is located in the northern and central part of this region and includes 515 communes (amounting to about 71.6 percent of the region's total number of communes). It takes in 78.3 percent of the region's population and 78.3 percent of the cultivated land (80.5 percent of wetlands). Cultivated land averages 1.09 mu per capita, but in most communes and brigades cultivated land averages less than 1.0 mu per capita. This is the part of the region in which population is concentrated, the workforce abundant, and both the level of development and intensivity of agricultural production fairly high. The land consists predominantly of hills, downlands and river valley flats below 500 feet above sea level. Dong [8211] fields are the dominant type of farmland, alluvial fields, ridged fields, and river bank fields being relatively few in number. Heat energy is abundant. However, distribution of precipitation varies throughout the year (from quarter to quarter), and from one year to another causing frequent drought. Development of water conservancy endeavors following liberation has fundamentally changed the former situation of rudimentary irrigation facilities dominated by the channeling of water into fields. A water conservancy and irrigation system consisting primarily of impounding water but linking impounding, diversion, and lifting of water, has been preliminary built. However, because people have used nature irrationally for a long period of time, plus the surface of the land's poor ability to withstand weathering and erosion and serious damage to ground cover, erosion has reached moderate proportions, and the ecological environment has become unbalanced. The undiversified nature of agriculture in which grain production dominates is fairly serious.

Table 94. Table Showing Characteristics of South Hunan Agricultural Region Types

			(a)丘、岗及盆地粮、油茶类型	(b)低山粮林类型	(c)中山以林为主类型
			(I)	(II)	(III)
(d) 1.地貌类型及特征：		①主要地貌类型 (e)	(f)红岩及灰岩丘陵 (i)红土岗地河谷平地	(g)灰岩、花岗岩浅变质岩 (j)及低山	(h)浅变质岩及花岗岩 (k)中山
		②主要水田类型 (l)	(m) 垌田为主	(n)冲垅、排田	(o) 冲、排田
		③海拔高度 (p)	<500M	500—800	>800
(q) 2.农业气候特征	(r)热量条件	①年平均气温(℃) (t)	17.7—18.7	17.6—15.0	<15.0
		②1月平均气温(℃) (u)	5.8—7.2	5.1—5.8	<5.1
		③7月平均温(℃) (v)	27.9—29.3	24.1—27.5	<24.1
		④年极端最低温(℃) (w)	-5.1—-9.0	-7.6—-8.7	<-8.7
		⑤年极端最高温(℃) (x)	39.7—43.7	34.2—39.7	<34.2
		⑥高于10℃的活动积温(℃) (y)	5500—5800	5200—4700	<4700
		⑦高于20℃终日(日/月) (z)	29/9—8/10	23/9—29/9	18/9以前
		⑧全年无霜期(天) (aa)	277—310	270—250	<250
	(s)水分条件	①年平均降水量(毫米) (ab)	1310—1470	1500—1600	>1600
		②年平均相对湿度(%) (ac)	79—81	≈82	>82
		③4—6月降水量占全年降水量% (ad)	42—48	<41	<39
		④7—9月降水量占全年降水量% (ae)	19—21	25左右	>25
(af) 3.土壤		①成土母质类型 (ag)	(ah)初期红土及河流冲积物	(ai)灰岩、浅变质岩及花岗岩	(aj)花岗岩及浅变质岩
		②主要水稻土 (ak)	(al)砂泥、黄泥及黑泥田为主	黄泥、岩渣子泥及鸭屎泥田 (am)	(an)粗砂泥、冷浸青夹泥田
(as) 4.农田水利条件		①灌溉水源类型 (ao)	(ap)蓄水为主，兼有引提灌溉	引水为主，兼有蓄水，提水灌溉 (aq)	(ar)引水灌溉类型
		②有效灌田占水田(%) (at)	85.1	80.1	90.9
		③旱涝保收面积占水田(%) (au)	68.7	65.7	70.0
		④高产稳产农田占水田(%) (av)	45.0	37.4	37.5
(aw) 5.耕地面积		①占全农业区耕地(%) (ax)	78.3	14.1	7.6
		②水田占耕地面积(%) (ay)	80.5	79.8	84.5
(az) 6.复种状况		①1975年双季稻占水田面积(%) (ba)	67.6	53.2	43.2
		②1975年一季稻占水田面积(%) (bb)	24.6	34.1	49.0
		③复种指数 (bc)	260	220	180
(bd) 7.粮食生产状况		①占全农业区粮食总产(%) (be)	80.3	12.9	6.8
		②粮食平均亩产(斤) (bf)	791	715	764

[Continued on following page]

		(a)丘、岗及盆地粮、油茶类型	低山(b)粮林类型	中山(c)以林为主类型
		(I)	(II)	(III)
(bg)8.经济作物播种面积	①甘蔗占全农业区(%)(bh)	87.8	5.9	4.3
	②烤烟占全农业区(%)(bi)	89.8	8.9	1.2
	③棉花占全农业区(%)(bj)	88.8	10.1	1.1
	④花生占全农业区(%)(bk)	87.6	9.9	2.5
(bl)☆9.森林及林业生产状况	①有林地面积比重(%)(bm)	16.8	30.2	53.0
	②木材蓄积量的比重(%)(bn)	14.3	32.9	52.8
	③茶油产量的比重(%)(bo)	76.5	13.2	10.3

Note * (1) Column's 4-8 based on 1975 statistics.
(2) Timber reserves figured on 1975 statistics for Linwu, Jianghua, and Ruicheng.
Wooded area figured on 1975 statistical data for Linwu, Rucheng, Jianghua, and Guidong counties.

Key:

a. Hill, downlands and basin grain and tea oil type
b. Low mountain grain and forest type
c. Central mountain predominantly forest type
d. 1. Terrain types and characteristics
e. (1) Major terrain types
f. Red stone and limestone hills
g. Limestone and granite epimetamorphic rock
h. Epimetamorphic rock and granite
i. Red earth downlands and river valley flatlands
j. Low mountains
k. Intermediate mountains
l. (2) Major wetland types
m. Primarily dong [8211] fields
n. Alluvial, ridged, and river shore fields
o. Alluvial and river shore fields
p. (3) Elevation above sea level
q. 2. Characteristics of agricultural climate
r. Heat conditions
s. Moisture conditions
t. (1) Annual average temperature (°C)
u. (2) Average January temperature (°C)
v. (3) Average July temperature (°C)
w. (4) Lowest annual temperatures (°C)
x. (5) Highest annual temperature (°C)
y. (6) Dynamic cumulative temperature (°C) above 10°C
z. (7) Final day when temperature is above 20°C (day/month)
aa. (8) Annual number of frost-free days (days)
ab. (1) Average annual precipitation (millimeters)
ac. (2) Average annual relative humidity (%)
ad. (3) Percentage of annual precipitation falling from April through June

ae. (4) Percentage of annual precipitation falling from July through September
af. 3. Soil
ag. (1) Types of soil-forming mother material
ah. Initial red soil and river alluvium
ai. Limestone, epimetamorphic rock and granite
aj. Granite and epimetamorphic rock
ak. (2) Principal paddy soil
al. Predominantly sandy soil, yellow earth, and black soil
am. Yellow earth, rock debris soil, and yashini soil
an. Coarse sandy soil, cold waterlogged intercalated blue mud fields
ao. (1) Irrigation water source type
ap. Mostly impounded water with irrigation through diversion and lifting of water as well
aq. Predominantly water diversion with some impounding and lifting of water for irrigation
ar. Diversion of water for irrigation type
as. 4. Farmland water conservancy conditions
at. (2) Percentage of wetlands effectively irrigated
au. (3) Percentage of wetlands from which a crop can be harvested despite drought or waterlogging
av. (4) Percentage of wetlands producing consistently high yields
aw. 5. Cultivated land area
ax. (1) Percentage of cultivated land in agricultural region
ay. (2) Percentage of cultivated land that is wetlands
az. 6. Status of multiple cropping
ba. (1) Percent of wetlands planted to two crops of paddy in 1975
bb. (2) Percent of wetlands planted to a single paddy crop in 1975
bc. (3) Multiple cropping index
bd. 7. Grain production
be. (1) Percent of total agricultural region grain production
bf. (2) Average grain yields per mu (jin)
bg. 8. Area sown to cash crops
bh. (1) Percent of total agricultural region's sugarcane
bi. (2) Percent of total agricultural region's flue-cured tobacco
bj. (3) Percent of total agricultural region's cotton
bk. (4) Percent of total agricultural region's peanuts
bl. *9. Status of forests and forestry production
bm. (1) Percent of forested area
bn. (2) Percent of timber reserves
bo. (3) Percent of tea oil output

The area sown to grain crops accounts for about 75 percent of the total area sown to agricultural crops. Statistics from 58 category I communes in Jiahe and Laiyang show 74.8 percent of the total area sown to grain and output value from grain accounting for 50 percent of total agricultural output value. In 1975, grain yields averaged 791 jin per mu. Eighty-seven percent of the area sown to cash crops was sown to sugarcane, flue-cured tobacco, cotton, and peanuts, and 67.1 percent of the wetlands area was sown to double crops of paddy. Only 24.6 percent of the wetland area was sown to one crop of paddy plus one crop of green manure (or the land allowed to lie

fallow during winter). The farmland multiple cropping index was about 260 percent. Forestry production does not occupy an important position in agricultural production (accounting for less than 5 percent); however 85 percent of the region's tea oil area and 90 percent of its major tea oil communes and brigades are concentrated here. The region has only a small area of timber forests, firewood forests, and erosion-prevention forests.

In this type, annual precipitation amounts to between 1,300 and 1,400 millimeters, and the average relative annual rate is 16-18 percent. Rainfall is fairly concentrated during the 3 months from April through June when 42 to 43 percent of the total annual amount falls. During the 4-month period July through October, less than 25 percent of total annual precipitation falls. The frequency and probability of drought is greater than 50 percent, drought occurring 7 or 8 out of 10 years. A major drought or an exceptionally major drought occurs once every 4 or 5 years. Despite rapid development of farmland water conservancy construction following liberation, a large amount of work still remains to be done in reviving the balance of the agricultural ecological environment in order to totally get rid of the threat that drought poses for agricultural production. About 20 percent of the wetland area of most communes consists of low yield fields, and increase in the level of their yields continues slow. In addition, in some communes and brigades, "three competitions" exist between grain and cash crops (competition for land, fertilizer, and workforces).

In view of natural conductions and production features of this type region, future development of agricultural production will require, first of all, future building of farmland water conservancy and improvement of low yield soils as the centerpieces of farmland capital construction, with active improvement of the farming system, increased sources of manure, and increase in the amount of fertilization for steady increase in yields per unit of area of both grain and cash crops. Development of cash crops must proceed from both national and long-term needs and also take into consideration the suiting of general methods to local situations, applying the principle of using strengths to offset weaknesses in a linking of strengths and weaknesses. So long as there is no reduction in the existing amount of cultivated land devoted to growing grain, there can be gradual expansion of the area sown to cash crops. Cash crop patterns should be concentrated in continuous tracts as feasible for the building of production bases. There should be vigorous development of animal husbandry production. The main job to be done in forestry production is to raise both yields per unit of area and gross output of tea oil through nurture and care of tea oil forests. At the same time, there should be some development of firewood forests and of forests to prevent erosion.

This type may be divided into six second grade types as follows: I_1 northern grain and oil type; I_2 middle reaches of the Chunling Shui grain and tobacco type; I_3 middle reaches of the Xiao Shui grain and sugarcane type; I_4 Lanli and Jiahe grain and hemp type; I_5 upper reaches of the Wu Shui grain, sugarcane, and hemp type; and I_6 upper reaches of the Xiao Shui grain and tobacco type.

II. Low Mountain Co-equal Grain and Forest Type

This type is found in low mountain regions at 500-800 meters above sea level. It includes 118 communes (or 16.6 percent of the total number of communes in the whole region), about 14.1 percent of the whole region's cultivated land (13.8 percent of wetlands), and 13.9 percent of the agricultural population. Average cultivated land per capita is 1.12 mu. The proportion of dryland is fairly large, wetlands accounting for only 79.9 percent of total cultivated area. Alluvial and ridged hills predominate, and there are also a substantial number of river shore fields. There are relatively few dong [8211] fields, and dong fields are found over only a very small area. The land is undulating with slopes of 5 degrees and above. Cultivated land is made up of yellow earth for the most part, but there is also a large amount of rock debris soil, yashi soil, and cold waterlogged intercalated blue mud. Irrigation through the channeling of water prevails virtually everywhere. Droughts have been serious throughout history. After liberation the water shortage situation remained unchanged. As of 1975 the effectively irrigated area amounted to only 80.1 percent of the wetland area, and only 65.7 percent of the wetland area could be counted on to deliver a crop despite drought or waterlogging. The farmland area from which a crop could be guaranteed despite drought or waterlogging averaged 0.34 mu per capita. As the terrain rises, sunlight and heat becomes limited on this type farmland. The threat from mountain shade and cold waterlogging increases. The double crop paddy-field area covers only 53.2 percent of the wetland area, with single crops of paddy being grown on 34.1 percent of the wetland area. The multiple cropping index averages only 200 percent. Large areas continue either to lie fallow or be flooded with water during winter. The agricultural production sector's structure also shows features of a transition toward the central mountain region, with equal emphasis on farming dominated by grain production and forestry. Output value of grain crops accounts for only 40 percent of the gross output value of agriculture. The level of production from the farming industry is relatively low. Even though the cultivated area is only 14.1 percent of the total area, grain output totals only 12.1 percent of the gross for the area. In 1975, yields averaged only 715 jin per mu, or an average of 712 jin per capita. This was about 50 jin less than for other type regions. The growing area for cash crops such as sugarcane that have fairly high heat and moisture requirements has decreased very greatly, while the growing of peanuts and flue-cured tobacco predominates. The yearly output value of forestry production amounts to about 20 percent of the gross output value of agriculture. Tea oil forests account for a certain proportion, and the proportion of timber forests has increased markedly. In Linwu County, for example, five communes of this type region (amounting to 41.8 percent of all communes in the county) have 31.8 percent of the county's timber forest area and 19.30 percent of the whole county's timber forest reserves. Its tea oil forest area is 41.3 percent of the county total, and in 1975 it accounted for 52.4 percent of the county's total output of tea oil.

In this type region, farmland water conservancy projects are very few, irrigation through the diversion of water predominating. Thus, the plentifulness of precipitation determines the size of farm outputs, and grain production is inconsistent. In most communes and production brigades, grain

and forest production conflict. A policy of simultaneous attention to grain and forests should be carried out, with one supporting the other. Active efforts should be made in farmland capital construction in an effort to change production conditions, and major efforts made to reform the farming system. Places having requisite conditions should develop the growing of two paddy crops as possible, grow hybrid paddy over wide areas, rotate wetland with dryland crops, and increase the soil utilization rate and yields per unit of area. They should handle properly relationships among grain, cash crops, and forestry production, plan equitably the distribution of workforces between agriculture and forestry, and promote development of forestry simultaneous with the growing of grain, animal husbandry, and sideline occupations.

This type is divided into seven secondary types as follows: II_1, the Yuecheng-Yangming grain and bamboo type; II_2, the Tashan grain, oil, and bamboo type; [II_3 omitted in source]; II_4, the Muzhu-Jiuyi grain, tea, and Chinese fir type; II_5, the Qitian-Nanling grain and pine type; II_6, the Zixing-Rucheng-Guiyang grain, pine, and bamboo type; II_7, the Anren, eastern Yongxing-Lingxian grain, oil, and bamboo type.

III. The Central Mountain Forestry-Predominant Type

This type includes 84 communes (or 11.8 percent of all communes in the region), and is found in the Yangming mountain area, the Jiuyi mountain area, and in the eastern and southeastern mountain area. These mountainlands are made up mostly of granite and epimetamorphic rock. Elevation above sea level is around 1,000 meters, with some mountain ranges rising as high as 1,500-2,000 meters, and valleys dropping as low as 800 meters. The mountains are high and the valleys deep, the terrain rising and falling fairly sharply. As a result, fields are scattered and the amount of heat insufficient. In addition, there is a shortage of labor, so an overwhelming majority of places use the land for forestry (Table 95). Only a portion of the valleys and some valleys and gentle slopes are used for farming, and account for 7.6 percent of the total cultivated land area in the region (7.9 percent of wetlands). Agricultural population is only 6.8 percent of the total for the region, and cultivated land averages 1.23 mu per capita. Relatively speaking, this is a region of sparse population relative to fields. Forestry production is relatively conspicuous, and for many communes and brigades, the output value of forestry accounts for 50 percent of the gross output value of agriculture year after year. Mostly grain is grown on cultivated land; however, grain output value generally accounts for only about 50 percent of gross agricultural output value. Precipitation is plentiful in the mountainlands averaging more than 1,600 millimeters in most years. Rainfall is evenly distributed with a relative annual rate of variation of less than 14 percent. Maximum monthly relative variation rate is less than 50 percent. In addition, the mountain forests are lush and their ability to conserve water is good. Despite a paucity of farmland water conservancy projects, irrigation conditions are still better than in the aforementioned two types. In 1975, the effectively irrigated area amounted to 90.9 percent of the wetland area. The area capable of delivering a harvest despite drought or waterlogging was 70.0 percent of the wetland area, and farmland capable of delivering a harvest

despite drought or waterlogging averaged 0.7 mu per capita. Paddy rice production aside, dryland grains accounted for 40 to 50 percent of total grain output. Few cash crops other than a small amount of peanuts and flue-cured tobacco were grown. The wetland farming system is undiversified. In 1975, single crop paddyfields accounted for 49 percent of the total wetland area, and the area allowed to lie fallow or flooded with water during winter was large. Since the amount of heat is insufficient in mountainlands, only 43.2 percent of the wetland area is planted to double crops of rice. This is limited to some small basins on the leeward side of mountains and to valleys whose yields per unit of area are not high. Grain yields average 764 jin per mu (including grain yields from the intercropping of grain and forest trees). Since population is scant relative to fields, grain yields average 774 jin per capita, which is more than for the type I and II regions. Forestry production consists mostly of timber. In the Jianghua mountain region, for example, 16 communes (or 41 percent of all communes in the county) have a forest area that is 60.4 percent of the county's total forest area, containing 80.5 percent of its timber reserves. Its tea oil forest area is only 15.9 percent of the county's total.

Table 95. Comparative Table Showing Structure of Land Utilization for Southern Hunan Category II and Category III Agricultural Region Types

		(a) II 低山林、粮并重类型	(b) III 中山以粮为主类型
(c)	土地总面积 (%)	100	100
(d)	1.农业用地占 (%)	14.2	10.3
(e)	2.林业用地占 (%)	56.6	66.8
(f)	3.荒山荒地占 (%)	23.0	17.5
(g)	4.水面占 (%)	3.0	2.5
(h)	5.其它用地占 (%)	3.2	2.9

Note: 1975 statistical data from five communes in Linwu County used as data for Category II type, and from eight communes in Rucheng County used as data for Category III type.

Key:

a. II Low mountain co-equal mountain forest and grain type
b. III Central mountain predominantly grain type
c. Percent of total land area
d. 1. Percent used for farming
e. 2. Percent used for forestry
f. 3. Percent of barren mountains and wastelands
g. 4. Percent of water surfaces
h. 5. Percent used for other purposes

In this type region, the low yield field area of mountain shade and cold waterlogged fields is large. In four communes in Zixing County, including Dongping Commune, for example, low yield fields make up 55.4 percent of the total wetland area. Mountain shaded cold waterlogged pangni [3316 3136] and deep yashini fields account for 62.2 percent of the low yield field area. The masses say, "The fields are shaded by the mountains; pang [3316] holes are waist deep; rusty water covers the fields, and the seedlings will not grow at all." Current yields are less than 500 jin per mu and as low as only 100-odd jin. Since either spring water or ground water from rock caverns is channeled for direct irrigation of most fields, and since its temperature is very low, warmth loving crops such as paddy rice do not grow well. In addition, mountain shade and insufficient sunlight in mountain regions causes more interference with photosynthesis and hurts efforts to increase output. The farming system is undiversified, and the soil utilization rate is not high. Between 40 and 50 percent of wetlands, or as much as 60 to 70 percent in some cases, are either flooded with water or allowed to lie fallow during winter. Furthermore, while working on forestry, some communes and brigades have neglected the growing of grain, animal husbandry, and sideline occupations. This has hurt commune member production and livelihood, and forestry production has also stagnated. Some communes and brigades have devoted themselves exclusively to grain production to the neglect of forestry. This has hurt national plans for forestry production. Consequently, this type region should adhere to an all-round program for development of taking grain as the key link and linking agriculture, forestry, and animal husbandry.

This type region may be divided into eight secondary types: The III_1 Yuecheng Range pine and bamboo type; the III_2 Yangming-Tashan Chinese fir and bamboo type; the III_3 Dupang Range deciduous forest type; the III_4 Mengdu-Jiuyi Chinese fir and tea type; the III_5 Mangshan special forest type; the III_6 Xishan pine, Chinese fir, and deciduous forest type; the III_7 Rucheng-Guiyang pine and mixed type; and the III_8 Wanyang Shan deciduous forest Chinese fir type.

(2) Secondary Agricultural Region Trial Zoning

Agricultural production is markedly regional, seasonal, cyclical, and inconsistent by nature. Not only are natural and economic conditions complex and agricultural sectors and crops rich and varied within a single province with much regional variation existing, but within a single agricultural region (such as the south Hunan agricultural region), as has been previously noted, very great regional variations are evident in agricultural production patterns. Agricultural region types are just a common ground for making an abstract generalization about the nature of agricultural production. There may be some overlapping of production patterns in space, and a sequencing of events may also exist in time. Consequently, one can only explain the similarities of this composite that is agricultural production as a classification and a concept that lacks regionality. This is to say that within a single region, the make-up of agricultural regional types will vary. Within a single region, only when a dominant agricultural regional type forms a special type combination will definite regional

agricultural production characteristics be formed. In the northern part of the south Hunan agricultural region, for example, a hill, downlands, and basin grain and oil type region predominates that differs from the hill, downlands, and basin grain and oil type, and from the low mountain co-equal grain and forest type of the central region. It differs even more from the central mountains of the southeast where forests predominate. Within these primary agricultural regions, regional variations objectively exist as a result not only of differences in natural conditions, but also as a result of a long historical process of regional division of labor. Therefore, in view of south Hunan's agricultural production situation, the south Hunan agricultural region may be further divided into four secondary zones inasmuch as: (1) a combination of agricultural regional type make-ups possess similarities within a given region; (2) the direction of development of agricultural production characteristics and of leading sectors is relatively identical in a given region; (3) agricultural production conditions are similar within a given region; (4) agricultural techniques and methods of increasing yields are relatively the same in a given region; and (5) efforts must be made to maintain intact people's commune boundaries.

1. The Northern Hill and Basin Grain, Oil, and Fruit Region. This region is located in the northern part of southern Hunan and includes Dongan and Laiyang counties, plus most of Lingling, Qiyang, Changning, Anren, and Yongxing counties, and some communes in Zixing for a total of 285 communes (or 40.3 percent of all communes in the region), a land area of about 12,000 square kilometers (or 25 percent of the total area), and 40 percent of the region's cultivated land. Wetlands account for 86.2 percent of cultivated land; agricultural population is 42 percent of the total for the region; and cultivated land averages 1.07 mu per capita. The agricultural regional type make-up is fairly simple. Mostly it is a category I_1 northern grain and oil type, with only a small area in the western fringe being a category II_2 Yuecheng-Yangming low mountain grain and bamboo type. The main characteristics of this region are: (1) Fairly flat terrain, and a fairly high reclamation index. The region is located in the lower reaches of the Xiao, Chun, and Lai rivers where most of the land is lower than 200 meters above sea level, and most of it is red rock hills and downlands, and river alluvial plains. Additionally, it is close to central Hunan where water and land transportation is convenient, making it the region in southern Hunan where agriculture developed earliest. More than 25 percent of the total land area, and in some places as much as 27 to 30 percent, is used for agriculture. The average reclamation index for southern Hunan (20.8 percent) is the highest of any region. (2) The commanding position of grain production is conspicuous, and the level of production is relatively high. Grain crops are grown on 91 percent of the cultivated land area, and in most years their output value accounts for more than 65 percent of the output value of the farming industry. In Lingling and Anren counties, grain crops account for more than 70 percent of the output value of farming. Because this region is located within the Shuangpai, Ouyanghai, and Qingshanlong large-scale irrigation areas, in 1975, 63 percent of the cultivated land area was able to deliver a crop despite drought or waterlogging. For Anren it was 70.6 percent, and for Yongxing 66 percent. This plus the intensivity of farming produced grain yields that were foremost in the

region. Gross output of grain crops accounted for 44 percent of the total for the region. Yields averaged 831 jin per mu, and grain output averaged 813 jin per capita of agricultural population. (3) Tea oil is the focus of forestry production. Economic forests account for more than 55 percent of the land used for forestry in this region. In the communes of Laiyang County, it is 72 percent; in Changning County 64 percent; and in Yongxing County, 62 percent. More than 95 percent of all economic forests are tea oil forests. Thus, virtually 45 to 50 percent of all the tea oil forest area of the entire southern Hunan region is concentrated in this area, and in most years it produces 50 to 55 percent of the region's tea oil output.

Population density is fairly high in this region (averaging about 301 people per square kilometer). The region is also close to cities and transportation lines, which have large needs for grain. At the same time, the region has abundant tea oil resources and a foundation in farming oil-bearing crops. For these reasons, this region should be built into integrated agricultural bases that produce primarily grain and oil-bearing crops, but which also diversify into growing fruit and raising hogs. The key to hastening agricultural production in this region lies in a speed-up of the capital construction of farmland and tea oil forest lands to change production conditions.

2. The Central Hill and Basin Grain and Cash Crop Region. This region is located in the central part of southern Hunan and includes most or all of Guiyang, Daoxian, Ningyuan, Xintian, Jiahe, and Lanshan counties, plus small parts of Jiangyong, Linwu, Chenxian, and Yongxiang counties. It covers a land area of approximately 7,985 square kilometers, which is 17 percent of southern Hunan's total land area. Both cultivated land area and agricultural population are 26 percent of the total for the entire agricultural region. Cultivated land averages 1.08 mu per capita. This region is located in the middle reaches of the Xiao and Chunling rivers, and is a hill type river valley basin at between 200 and 500 meters above sea level. The make-up of this agricultural regional type is fairly complex, most of it falling in the three secondary I_2, I_3, and I_4 types, and some of it falling into the II_2, II_3 and II_4 types. Main features are as follows: (1) A hemmed-in topography with plentiful heat and insufficient water, the percentage of drylands being great. The Yangming-Tashan mountainlands screen this region in the north, so in winter the effects of cold air currents are rather weak; temperatures are relatively high (in Daoxian County, the average temperature during January is 7.4°C), and heat is plentiful (in Daoxian County, cumulative temperatures of 10°C or above reach 5,852°C). However, precipitation declines as a result of the terrain (annual precipitation in Xintian County is only 1,314 millimeters). Karst topography is widespread in the area as a result of which surface water sources are not plentiful, making this a major seasonal drought region in southern Hunan. In 1975, only about 50 percent of the cultivated land in the entire sub-region could guarantee a crop despite drought or waterlogging. Water conservancy conditions are poor, and the dryland area is naturally large amounting to 27 percent of the total cultivated land area, including 32 percent in Jiahe County, 31 percent in Daoxian County, and 30.5 percent in Guiyang County, making these counties the places with the highest percentage of dryland

area in southern Hunan. (2) Grain production levels are not high. Grain crops take up 81 percent of the total cultivated land area, and 25 percent of the southern Hunan agricultural region is sown to grain crops, yet the southern Hunan agricultural region accounts for only 23.9 percent of gross grain output. Yields average 802 jin per mu, and yields average 705 jin per capita (including Ningyuan with 657 jin per capita and Jiahe with 668 jin per capita), making this region the one with the lowest grain yields per capita in the southern Hunan agricultural region. (3) Cash crops are of many kinds and a large percentage of the total. According to 1975 statistics, 47.3 percent of the area sown to peanuts in the southern Hunan agricultural region, 52.8 percent of the area sown to flue-cured tobacco, 29.4 percent of the area sown to sugarcane, and 60.8 percent of the area sown to ramie was located here, and 53.8 percent of the southern Hunan agricultural region's gross output of peanuts, 54.1 percent of flue-cured tobacco, 31.7 percent of sugarcane, and 60.1 percent of ramie were produced here. This is a major growing area for cash crops in southern Hunan. (4) Tea oil forests are the most important kinds of forests. These tea oil forests account for 20 percent of southern Hunan's tea oil forest area, and 18 percent of its annual tea oil output, making this area second only in importance to the northern sub-area in output of tea oil.

In view of the natural and social conditions of this region's agricultural production, as well as the prevailing character of production, this region lends itself to construction as a grain and flue-cured tobacco, sugarcane, ramie, and oil-bearing crop base. To this end, it will be necessary to hasten the building of farmland water conservancy, and improve capabilities to withstand drought in order to assure consistently high yields despite drought or waterlogging.

3. Southeastern Mountainland Forest, Grain, and Hemp Region. This sub-region includes Lingxian, Guidong, Rucheng, and Yizhang counties, most of Zixing and Chenxian counties, and a part of Linwu, Anren, and Yongxing counties for a total of 128 communes and a 13,900 square kilometer land area, which is 29 percent of the southern Hunan agricultural region, and 19.7 percent of the cultivated land area. It has 16.8 percent of the agricultural population, and cultivated land averages 1.31 mu per capita making this a region of scant population relative to the amount of fields in the southern Hunan agricultural region. Its major features are as follows: (1) High percentage of land used for forestry, the forests consisting principally of pine and miscellaneous kinds of trees. Over 80 percent of the land area is used for forestry, including 82.5 percent in Guidong County, and 89 percent in Lingxian County. The percentage of land used for farming is small, by contrast and the reclamation index low, averaging 8.5 percent. In Lingxian, Guidong, and Zixing counties, it is only 5 to 7 percent, and in Rucheng and Yizhang counties, it is less than 10 percent. A prominent feature of forestry is the high percentage of pine and miscellaneous trees, and high reserves per unit of area. In Rucheng County, for example, the pine and miscellaneous forest area is 68.4 percent of the total forest area, and reserves are 79.8 percent of total reserves. Reserves of pine and miscellaneous trees per unit of area amount to 8.11 cubic meters per mu, which is 5.01 cubic meters per mu higher than reserves of Chinese fir per

unit of area. (2) The percentage of wetlands is high. Mostly paddy rice is planted, but yields are low. This region is affected by the terrain. Precipitation is plentiful, much rain falling in autumn. It has good sources of water, and the certainty that water will be available for agriculture is high. The percentage of wetlands is fairly large (wetlands accounting for as much as 86.6 percent of the cultivated land area). The farmland area from which a crop may be assured despite drought or waterlogging is also relatively high. In Lingxian and Guidong counties, a crop can be guaranteed from more than 71 percent of the cultivated land area despite drought or waterlogging. More than 80 percent of the total area sown to grain in the sub-region is sown to paddy rice, and in Zixing, Lingxian, Rucheng, and Guidong counties, the percentage is greater than 90. Gross output of paddy accounts for more than 90 percent of gross grain output, and for as much as 97.7 percent in Zixing. Clearly the degree of undiversified farming is high. However, in this sub-region population is scant relative to fields; the mountain forest area is vast; the labor force is insufficient; the farming system is undiversified; farming is extensive rather than intensive; and grain yields are relatively low. In 1975 grain yields averaged only 733 jin per mu, and only 644 jin in Lingxian County. (3) The mountainlands are not used to the full, and a great potential exists for their multiple use. Though the forest area in this region is vast, nevertheless, in the main forest regions, timber reserves average only 3.3 cubic meters per mu, 2.3 cubic meters per mu less than the forest regions of the upper reaches of the Yuan Shui. Barren mountains and cut-over land amounts to about 20 percent of the mountainland area; more than 21 percent in Yizhang, Guidong, Zixing, and Rucheng counties. Consequently, a great tapable potential exists from simply using existing forestlands and increasing reserves per unit of area.

This region should develop its mountainland resources by emphasizing multiple uses of forestry resources. In addition to greater diversity of timber forests, the region should also actively develop some economic forests, and the production of forest sideline products such as medicinal herbs and tea. In addition to efforts to increase grain yields from existing cultivated land, the farming industry should also develop some cash crops as feasible. Mountain and hill valley areas, in particular, with fertile soil, warmth and moisture, and free from the threat of autumn drought are suited to the growth and development of ramie.

4. Southwestern Mountainland Forest, Grain, Tobacco, and Tea Region. This region includes the intermediate mountain predominantly forest agricultural region type, consisting of Yangming Shan, Ta Shan, Dupang Ling, Mengzhu Ling, and the Jiuyi mountainlands, plus part of the low mountain co-equal forest and grain type, hill basins where grain predominates, and cash crop types with a total of 150 communes and a land area of 13,700 square kilometers, which is about 28.6 percent of the area of the southern Hunan agricultural region and 14.5 percent of its cultivated land. It has 15.8 percent of the agricultural population, and cultivated land averages 1.02 mu per capita, making it a region in southern Hunan with scant population and scant cultivated land (about 101 people per square kilometer). The most important features of agricultural production in this sub-region are as follows:

(1) A vast amount of land used for forestry and a low reclamation index. More than 90 percent of the land area in the sub-region is used for forestry, making it the region among the secondary regions with the highest percentage of land used for forestry. Little land is used for farming, so the reclamation index is naturally low, averaging only 6.5 percent. For Shuangpai County, the index is only 2.7 percent. (2) Chinese fir forests predominate, with a fairly high percentage of bamboo forests. Except for Dupang Ling, in most areas Chinese fir forests account for more than 40 percent of the forestland area. In the Shuangpai and Jianghua forest regions, fir forests account for 48.2 percent of the forestland area. Second is numerous bamboo forests. In Shuangpai County, for example, moso bamboo reserves amount to 38.68 million stalks. Lanshan and Jianghua counties have a substantial amount of moso bamboo. (3) Undiversified farming and a low level of production. Grain accounts for more than 90 percent of the area sown to farm crops. Since water conservancy facilities are rudimentary, the actual extent to which crops may be guaranteed from farmlands is low. In addition, the percentage of dryland grain is high; farming is extensive rather than intensive; and grain yields are low. In 1975, yields averaged 745 jin per mu. This included yields averaging less than 700 jin per mu in Jianghua and Jiangyong counties. Grain yields averaged 701 jin per capita. Cash crops have developed substantially in recent years. In area sown and gross output, sugarcane and flue-cured tobacco amount to 35 and 20 percent of the totals for the southern Hunan region.

Development of forestry in this region should concentrate primarily on raising the timber output rate of existing forestlands, strengthening all-round production, and building new type bases made up of different kinds of forest trees such as Chinese fir, pine, miscellaneous trees, and bamboo, good performance in multiple uses of forestry sideline products, and appropriate expansion of the economic forest area (such as suitable development of tung oil forests in limestone mountainlands). Mountainlands are wet and foggy, so tea grows fast there; many pickings are possible; and quality is good. More commune and brigade tea farms should be developed and there should be steady expansion of the tea plantation and picking area, promotion of superior varieties, increase in quantity, and improvement of quality. The farming industry should place most emphasis on increasing yields per unit of area, expanding the cultivated area as conditions permit. Farmland capital construction should be actively developed, fertilization increased, and general methods suited to specific circumstances for a readjustment of crop patterns and the multiple cropping system.

Chapter 6. Western Hunan Agricultural Region

The western Hunan mountainland agricultural region is located in the western part of the province. It includes the Western Hunan Tujia Nationality and Miao Nationality Autonomous Zhou, Qianyang Prefecture, Shimen and Cili counties in Changde Prefecture, Anhua County in Yiyang Prefecture, Xinhua County in Lianyuan Prefecture, and Longhui, Dongkou, Wugang, Suining, Chengbu, and Xinning counties in Shaoyang Prefecture. The whole region consists of 31 counties and two municipalities, and covers an area of approximately 79,800 square kilometers, which is 37.7 percent of the total area of the province. It is the region with the largest area among Hunan Province's four major agricultural regions.

In 1979 the Western Hunan Agricultural Region had a population of 12.56 million, or 24 percent of the provincial total. This included an agricultural population of 11.55 million, or 92 percent of the region's total population. It had members of the Tujia nationality, Miao nationality, Dong nationality, Yao nationality and Zhuang nationality making it the region in the province with the greatest concentration of fraternal nationalities. In accordance with the party's nationality policies, the Western Hunan Tujia Nationality and Miao Nationality Autonomous Zhous, two Dong nationality autonomous counties in Xinhuang and Tongdao, and the Chengbu Miao Nationality Autonomous County were established.

First Section. Agricultural Production Conditions

1. Terrain Features and Their Effects on Cultivated Land

(1) Terrain Features

The mountainlands are vast and rise and fall precipitously. Mountainlands occupy about 80 percent of the total area of the Western Hunan Region. Elevation ranges from 500 to 1,000 meters above sea level, and the terrain consists mostly of intermediate and low mountains. In northwestern Hunan, the Wuling Shan tower, and in southwestern Hunan, the Xuefeng Shan coil around. The main peak of the Xuefeng Shan, Luowengbamian Shan, rises to a height of 2,174 meters. Relative height ranges from 300 to 700 meters. Mountain ranges rise one after another and ravines fall away steep and deep. A vast amount of land suitable for forestry and animal husbandry lies in the vast mountains. Throughout the region, 84,426,000 mu of land, or more than 70 percent of the region's total land area is used for forestry. This is 45 percent of the total land area in the province devoted to forestry. In addition there is 26.77 million mu of barren mountains and cut-over land, which is 53 percent of the total barren mountain and cut-over land area in the whole province. The region has more than 10 million mu of grassy mountains and slopes. A preliminary survey conducted in Qianyang Prefecture shows 7.79 million mu of grassy mountains and slopes suited to the raising of livestock. This includes continuous tracts of grasslands of more than 10,000 mu each at 155 different places. Conditions favor development of agriculture in mountain regions; however, there are definite limits on the reclamation of land for farming. The region presently has 12.97 million mu of cultivated land, or 10.8 percent of the region's total land area.

Karst topography is well developed and exists over a wide area. Twenty-four of 31 counties, or 77.4 percent of all counties in the region, have karst topography. In each of the counties of the northwestern autonomous zhou, as well as in Shimen and Cili, surface material is principally limestone with sandy shale second. Karsting is widespread and most developed in treeless limestone uplands. It is found mostly in the northern part of Fenghuang County at Shirongqi in Yongshun County, at Sanchacun in Dayong County, and to the northwest of a line running from Chengguanzhen in Cili County to Weixinchang in Shimen County. The terrain declines gradually from the northwest to the southeast giving rise to multi-level mesas, some of the best developed of which are 800 to 1,000 meters high and have broad flat tops, maintaining somewhat the appearance of high plateaus. The soil layer is fairly thick and suitable for cultivation or else for development as livestock farms. Lowlands and eroded valleys are suited to development of paddyfields. However, most of the surface water flows from fissures and caverns, so drought is an ever present threat. Springs and underground streams frequently crop up in the treeless limestone uplands and limestone mountainlands, and on associated wooded escarpments, and are a possible source of water for farmlands. But the water temperature is low, and the water contains much calcium, which can result in cold, waterlogged fields or yashi soil fields. During the rainy season, the hemmed-in lowlands and the eroded valleys are frequently in danger of waterlogging and water

stagnation as a result of the accumulation of rainfall and the gushing forth of large quantities of ground water.

Xinhua, Longhui, Dongkou, Wugang, and Xinning counties on the southeastern side of the Xuefeng Shan are crisscrossed with karsted hills and karsted plains. North and south of the Dongkou County county seat in the eastern foothills of Xuefeng Shan in the area from Menggong City to Yangqi Commune in Xinhua County are diluvial and alluvial downlands. This region is suitable for development of dryland crops, citrus, and tea.

Southwest of a line running through Yuanling, Chenxi, Huaihua, and Xupu, as well as in Jingxian County, are found karsted low mountains and hills and karsted red soil hill-like plains. The limestone and red soil hill-like plains at Liangshuijing in Yuanling, in Huaihua, and in Jingxian as well as the eroded lowlands of Chenxi and Tianwan are places where farming is fairly well developed.

Narrow valleys are numerous and basins dot the region like stars in the sky. The western Hunan region has been powerfully uplifted by new diastrophic movements, and the cutting action of rivers has been intense, creating narrow valleys several hundred meters deep. There is little cultivated land in these narrow valleys where the hours of sunshine are short and where mountain-shaded fields are numerous. Nevertheless, water power resources are plentiful in these narrow valleys. In parts of the western Hunan region, basins have been imbedded like stars among the lofty ranges, and most are traversed by rivers. Fairly large basins include the Sanzhi Basin, the Dayong Basin, and the Cili Basin along the shores of the Li Shui, plus the Anjiang Basin, the Zhijiang Basin, the Huaihua Basin, and the Xupu Basin in the Yuan Shui drainage area. To the east of Xuefeng Shan lie the Xinhua and Lianyuan basins, and the Dongkou, Longhui, and Shaoyang basins, only parts of which lie within this region. In addition, there is the Longshan Basin in the northwest corner of the province. These basins are broad with developed alluvial plains and downlands. They are the places in western Hunan region where population and cultivated land are concentrated and where agriculture is well developed.

(2) Three Major Features of Cultivated Land

The high mountains, deep valleys, and steep slopes have resulted in the following three features for cultivated land in the western Hunan region:

First is marked changes in the vertical location of cultivated land. The table provided below (Table 100) shows 8 million mu, or 59.3 percent of the total cultivated land area, to be below 500 meters, with paddyfields at this elevation accounting for 63.2 percent of the entire region's paddyfield area. This is the region's farming heartland. Above 800 meters is 1.87 million mu of cultivated land, or 14 percent of the region's total cultivated land area, with drylands here accounting for 22.1 percent of the region's total dryland area. A very large percentage of the province's high and cold mountain region cultivated land area lies here.

Table 100. Table Comparing Cultivated Land Distribution at Different Elevations in the Western Hunan Region[1]

	(a) 海拔高度	(b)水田		(c)旱土		水田旱土合计 (d)	
(e)	(米)	(f) 面积 (万亩)	占水田总面积的比重(%) (g)	(f) 面积 (万亩)	占旱土总面积的比重(%) (h)	(f) 面积 (万亩)	占耕地总面积的比重(%) (i)
(j)	500米以下	610	63.2	190	51.1	800	59.8
(k)	500—800米	250	25.9	100	26.8	350	26.2
(l)	800米以上	105	10.9	82	22.1	187	14.0
(m)	总计	965	100	372	100	1337	100

1. This table is based on 1973 figures, which diverge slightly from 1949 statistical figures.

Key:

a. Elevation above sea level
b. Wetlands
c. Drylands
d. Total of wetlands and drylands
e. Meters
f. Area (10,000 mu)
g. Percentage of total wetland area
h. Percentage of total dryland area
i. Percentage of total cultivated land area
j. 500 meters and below
k. 500-800 meters
l. More than 800 meters
m. Total

Second, a large percentage of cultivated land is drylands, the most in the whole province. Of the 12.97 million mu of cultivated land in the region, 3.6 million mu is drylands. This is 28 percent of the region's total cultivated land area and 32 percent of the province's total drylands area. Consequently, emphasis on both wetland and dryland farming and on paddy rice and dryland grain production are of extremely major importance in the western Hunan region. (Figure 55)

Third, the fields are higher than the water supply, and cultivated land is dispersed over a wide area. In the western Hunan region, mountains are high; valleys are deep; and slopes are steep, with the result that fields are high while water is low. The lifting of water is of extremely major significance in this region. Because of the effects of the mountains, very great differences exist in the concentration or dispersal of farmland. River valley flatland areas and high mountain tableland areas form continuous tracts for farming. In mountainland narrow valley regions there are numerous "little mounds," and "conical hills with some flat land at the base," but very little continuous tract farmland. Terraced fields on slopes are numerous as, for example, in Qianyang Prefecture where 99.5 percent of the 620,000 mu of drylands are on slopes. Approximately 60 percent of the drylands have a gradient greater than 25 degrees; the soil layer is thin; and farming is done only with difficulty. The space between terraces on terraced fields is very high, running a general 1-1.5 meters and as high as more than 3 meters.

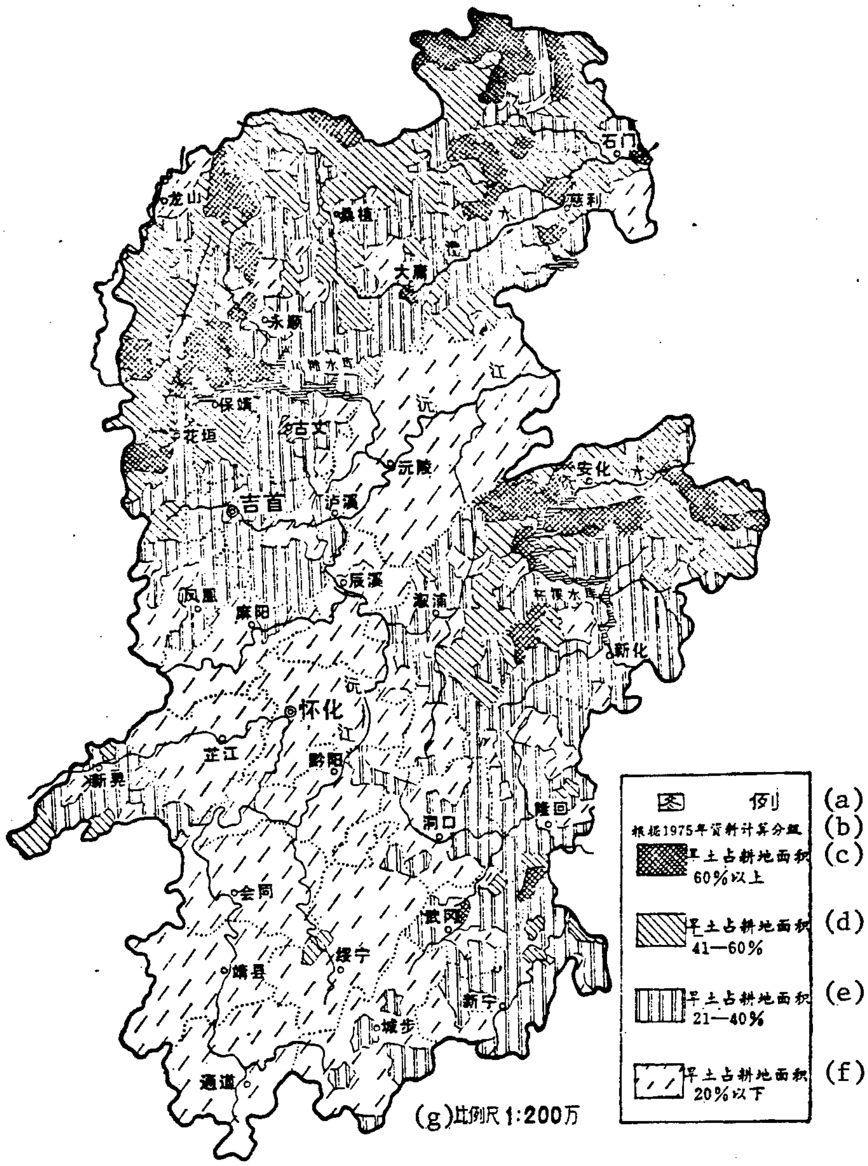


Figure 55. Classification Map Showing Drylands as a Percentage of Cultivated Land Area in the Western Hunan Agricultural Region

Key:

a. Legend
b. Classification based on calculations made from 1975 data
c. Drylands greater than 60 percent of cultivated area
d. Drylands between 41 and 60 percent of cultivated area
e. Drylands between 21 and 40 percent of cultivated area
f. Drylands less than 20 percent of cultivated area
g. Scale: 1:2,000,000

(3) Five Types of Wetlands

Paddyfields in this region may be divided into five kinds as a result of the effects of terrain and topography, as follows:

River-side fields, most of them along the banks of the Li Shui, Yuan Shui, Zi Shui and their tributaries, mostly below 500 meters above sea level and concentrated in basins where the terrain spreads out, light and heat conditions are good, the soil is fertile, and water resources plentiful. Approximately 30 percent of the wetland area is in such places. Some intermediate and small size water conservancy projects and electromechanical drainage and irrigation facilities have been established, and water conservancy conditions are fairly good.

Creek-side fields. These are found on both banks of creeks and brooks and account for approximately 25 percent of the wetland area. Some water conservancy facilities exist and the drop in streams is great providing good conditions for development of turbine pumps and small hydroelectric stations.

Mountain alluvial fields. These are found mostly at the headwaters of mountain creeks and brooks and account for 12 percent of the wetland area. Most are mountain-shaded cold, waterlogged fields; water conservancy facilities are few and far between, and irrigation by channeling water along furrows and flood irrigation is practiced everywhere.

Mountain slope fields. These are terraced fields on mountain slopes where water conservancy conditions are poor, and the fields rely mostly on natural rainfall. However, springs and ground water may also be used. Such fields account for about 25 percent of the total wetland area.

Flat top high mountain fields. Tableland fields at an elevation of around 500 meters in western Hunan are called flat top high mountain fields. They are found on high mountain tablelands, and account for about 8 percent of the total wetland area. Most fields lie in continuous tracts; water conservancy conditions are poor; population is sparse relative to the amount of fields; and farming is extensive rather than intensive.

2. Soil and Its Utilization Characteristics

(1) Great Regional Variations in Soil Mother Materials; Striking Pattern of Vertical Soil Distribution

In Xuefeng Shan, the soil-forming mother material is mostly phyllite, shale, and slate. The region between Zhenqi to Yuanling is one of high concentration of Tertiary Era purple shale. In the Wuling Shan region and to the east of Xuefeng Shan, limestone predominates. Granite is found in southern Xupu, northern Longhui, and southern Chengbu. Regional differences in soil-forming mother materials have brought about regional differences in the nature of the region's soil. (Table 101)

Table 101. Relationship of Different Mother Materials to Fertility

	母 (a) 质	水 (b) 分 %	有效 (c) 磷 斤/亩	交换 (d) 钾 斤/亩	全 (e) 氮 %	有 (f) 机质 %
(g)	石灰岩	2.87	1.73	28.47	0.182	1.97
(h)	板页岩	2.8	1.78	23.93	0.135	1.52
(i)	紫色页岩	3.75	12.10	25.20	0.160	1.84
(j)	花岗岩	2.8	5.98	42.99	0.114	1.53
(k)	冲积土	2.75	2.89	30.31	0.106	1.38

(Based on Hunan Paddyfield Rice Farming Investigation and Study Report)

Key:

a. Mother material
b. Moisture (%)
c. Effective phosphate (jin/mu)
d. Exchangeable potash (jin/mu)
e. Complete nitrogen (%)
f. Organic matter (%)
g. Limestone
h. Phyllitic shale
i. Purple shale
j. Granite
k. Alluvium

The yellow earth derived from limestone in northwestern Hunan is neutral to slightly alkaline and is suited for the growing of trees such as tung oil, Chinese tallow, lacquer, Eucommia, glossy privet, and Chinese sumac. Paddyfields developed from limestone and purple shale have fairly clayey soil, and the soil contains substantial amounts of nitrate nutrients. Soil derived from limestone contains substantial amounts of calcium and is prone to form into mud balls. Yashini soil is found over a wide area, and is lacking in both organic material and effective phosphate. Soils developed from purple shale have an effective phosphate content that is 1.37 to 4.5 times that of soils developed from other mother materials. Purple soils are suited to the growing of cedar, but not Chinese fir. Soils developed from slate are friable and ventilated, with plentiful nutrients. They are suitable for the growing of Chinese fir. Soils that have developed from granite mother material are fairly light; they contain little nitrate but usually substantial potash. Their ability to retain water and fertilizer is fairly poor, however. Some lack potash as a result of leaching. The granite rock area is fairly vast, and the surface soil covering it is prone to peel off with winter freezing making it bad for the growing of Chinese fir.

In western Hunan where mountain ranges roll on one after another and the land rises and falls sharply, variations in the vertical pattern of soil distribution are striking. Yellow earth and purple earth are found mostly below 500 meters. Mountainland yellow and red soils are found mostly between 500 and 1,000 meters. Mountainland brown soil is found at between 1,000 to 1,400 meters. Mountainland meadowland soil is found above 1,400 meters. Agricultural soil also exhibits a pattern of vertical variation. See the following table (Table 102) for distribution characteristics and properties.

Table 102. Distribution Characteristics and Properties of Western Hunan Region Agricultural Soils

	Areas of distribution	Soil properties
Wetland Soils:		
Sandy chaoni soil	Found on both banks of the main stream and tributaries of the Yuan, Li, and Zi rivers. Formed as a result of flooding with silting.	Soil layer is friable and fertile. Where light conditions are good, it is suited to the growing of a wide variety of crops. Poor water and fertilizer retention.
Black ni soil	Found mostly near building sites on flat terrain.	Deep soil layer, thick cultivable layer, fertile, plentiful nitrogen, suitable for growing a wide range of crops.
Baishan ni	Found in fairly flat places in mountain regions, on ridged fields on slopes, and on fairly wide mountain alluvial fields.	Thick soil layer, clayey soil, strong water and fertilizer retention, lower layer clayey and leathery.
Maganni soil	Found in ridged fields at the foot of gently sloping hills in the purple rock region of Yuanling and Zhenqi counties.	Lacking in nitrates; plentiful phosphate and potash.
Huangni soil	Found in slope fields and terraced fields in large mountain areas or at the foot of large mountains and on tablelands of low mountains and hills.	Tends to be heavy and of moderate fertility. Soil maturity poor in some fields, with slight organic content.
Cold sandy ni soil	Found in high mountains on both sides of cold water narrow valleys and creeks.	Much sand and little clay; poor soil quality, low fertility as a result of mountain floods. Cold water in high mountains causes delay in season.
Rock debris soil	Formed mostly from drift deposit or cliff debris on valley floors.	Soil layer contains numerous pieces of stone, which makes for difficulty in farming, low fertility, loss of fertility and loss of water.

	Areas of distribution	Soil properties
Yashini soil	Found mostly in low ridged fields and in fairly low-lying alluvial fields in mountain regions.	Clayey; water and fertilizer do not mix in soil.
Cold water-logged fields	Found mostly in mountain valley mountain alluvium in mountain regions.	High water table, deep mud, poor drainage, inadequate sunlight, low soil and water temperature.
Dryland Soils:		
Sandy chao soil	Found on both banks of rivers.	Mostly an intermediate soil that is friable and fertile and suited for the growing of a wide variety of crops.
Heini soil	Found mostly near inhabited sites.	Thick soil layer, abundant organic matter, easily tilled.
Yellow sandy soil	Found mostly on fairly precipitous mountain slopes.	Soil is friable and porous. Manure decomposes readily; poor water and fertilizer retention.
Yellow soil	Found mostly in hills, table-lands, and at mid-level on mountains.	Moderate soil fertility; dead yellow soil is clayey, acidic, infertile, and dry.
Magan soil	Considerable amount in Zhenqi, Huaihua and Yuanling counties, and on gentle mountain slopes.	Soil layer fairly thick; considerable phosphate and potash; most suitable for the growing of peanuts, pulse crops, and sweet potatoes.
Rock debris soil	Found generally on fairly steep mountain slopes.	Shallow soil layer with numerous pieces of rock.

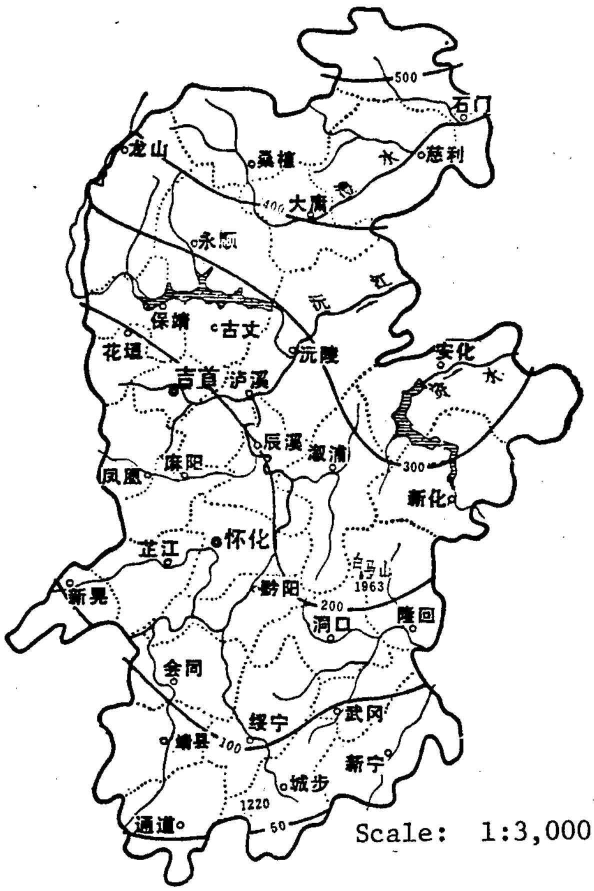
(2) Characteristics of Soil Use and Nurture

Use and nurture of soil means a change from allowing the soil to lie fallow to nurturing it and using it at the same time. Farming used to be done in a fairly extensive manner in the western Hunan region, and the main way in which the conflict between land use and land nurture was solved was by allowing the land to lie fallow. Up until the time of liberation, wetlands depended mostly on storage of water in the fields themselves to resist drought, and the fields were completely inundated during winter. Though winter flooding of fields helped the accumulation of organic matter and the latent fertility of the soil was also fairly high, nevertheless the long-term

drowning of fields in winter meant that the soil had very little opportunity for sunning and weathering, and it was in an anerobic state for a long period of time. In addition, with the long winter immersion, soil particles dispersed; mud balls gradually floated upward then sank; soil temperature dropped; organic matter and nitrates decomposed with difficulty, and the soil could not be easily tilled. Most important, during the winter fallow or winter immersion periods, it was all nurture and no use. After liberation, winter immersion gradually gave way to winter dryness, and winter fallow gave way to winter planting in a change to the rotation of wetland and dryland crops. Thus, the soil could be used to a high degree and soil fertility could be steadily increased at the same time. As far as wetlands are concerned, the main difference between fields that are immersed in winter and those that are kept dry in winter are as follows: 1) Winter-flooded fields are drowned year-round while fields that remain dry in winter are dry except during the period the paddy is growing in them. 2) In winter-dry fields, during the time of irrigation moisture percolates downward from the surface layer, while in winter-flooded fields virtually no movement of water occurs. Clearly the main difference between winter-flooded and winter-dry fields lies in the difference in moisture conditions that gives rise to changes in soil properties.

Going from widespread use of the soil's natural fertility to nurturing the soil: Up until liberation, slash and burn farming was the general rule in the western Hunan region. Though this practice enlarged the cultivated land area and was a way of making wide use of the soil's natural fertility, it seriously damaged the development of forestry, hastened soil erosion, and reduced soil fertility (Figure 57). Today slash and burn farming has been brought under control. In the western Hunan region, population is scarce relative to cultivated land, and the cultivated land is spread over a wide area. Fertilizer is very little applied to slightly distant fields, and there are also "immaculate fields" that receive no fertilization whatsoever. In addition, however, the multiple cropping index has been increasing steadily, and this has reduced the amount of fertilization of the area sown. Wide use of the soil's natural fertility is already unable to meet needs for development of large-scale socialist agriculture. As a result, year by year this region is quickening the pace in increasing levels of fertilization, in improving low yield fields, and in building farmland that produces consistently high yields (Table 103).

1) The percentage of farmland producing consistently high yields has risen from about 11 percent in 1973 to around 27 percent in 1979, and the percentage of cold waterlogged fields is in process of declining. This reflects development away from wide use of the soil's natural fertility toward nurturing the soil. Nevertheless, the percentage of farmland producing consistently high yields is still very low, and this is one of the major reasons occasioning this region's low and inconsistent grain yields per unit of area. 2) The task of improving low yield fields is a great one. The cold waterlogged fields of the autonomous zhou and of Qianyang Prefecture still account for 9.8 percent of the total wetlands area.



Scale: 1:3,000,000

Figure 57. Map Showing Distribution of the Average Soil Erosion Modulus for Many Years in the Western Hunan Agricultural Region

Table 103. Table Showing the Percentage of Wetlands Producing Low and Inconsistent Yields and Consistently High Yields in Qianyang Prefecture and the Western Hunan Autonomous Zhou in 1975 and 1973

	(a) 低而不稳农田(注)		(d) 高产稳产农田
	(b) 冷浸田	(c) 天水田	
1973年	16%	25.2%	11%
1975年	9.8%	19.9%	19%

Note: Not all fields with low and inconsistent yields have been listed, but rather only cold waterlogged fields and fields dependent on rainfall for comparison purposes.

Key:

a. Low and inconsistent farmland (Note)
b. Cold waterlogged fields
c. Fields dependent on rainfall
d. Consistently high yield farmland

(3) Vast Sources of Fertilizer and Great Potential for Use

First of all, the western Hunan region has plentiful soil resources, much reclaimable wasteland, much grassland, and abundant livestock fodder. It holds great potential for the opening of fodder bases, development of an animal husbandry industry, hog raising, and the collection of manure. Secondly, many of its fields are flooded with water during winter. A change from winter flooding to winter planting would help production of green manure. In addition, green mountains abound, and mountainlands can be used to establish manure bases. Third, the region has a long history in the development of woody oil-bearing plants and rape, and it is suited to the growing of woody oil-bearing plants and rape. Potential for development of cake fertilizers is great. Fourth, there is an abundance of minerals for the chemical industry, and hydropower supply is readily at hand. Thus, conditions for development of a chemical fertilizer industry are good.

3. Atmospheric Temperature Characteristics and Their Effects on the Crop System

(1) Atmospheric Temperature Characteristics

Winters are mild and summers are cool. Cold weather arrives early in autumn. As a result of the northeast-southwest orientation of the mountain ranges of the western Hunan region, with Huping Shan and Badagong Shan along the northern border at a very high elevation above sea level, the mountainlands play a definite role in blocking the flow of cold and warm air currents. As a result, the climate of this region is characterized by moderate winters and cool summers. Temperatures throughout the region average 16°C-17.3°C. South of a line running through Chengbu, Suining, and Jingxian, and west of a line running through Sangzhi, Yongshun, and Huayuan, the annual temperature averages less than 16°C. The frost-free period is longer than in places to the east at the same latitude. For example, it is 7 days longer in Jishou than in Changsha, and 5 days longer in Zhijiang than in Shuangfeng. Low temperature is generally above -7°C, higher than at the same latitude to the east of this region. The absolute minimum temperature isopleth also tends to decline from the east toward the southwest and northwest. January temperatures average higher than at the same latitude to the east of this region. In most years, the January temperature averages 5.1°C in Dayong, 0.8°C higher than in Changde. In Cili, the January temperature averages 4.9°C, which is 0.7°C higher than at Yueyang. In July, the average temperature is usually below 28°C, which is lower than any place else in the province. As a result of the weakening of solar radiation after August, and the relatively high topography, the temperature drops rapidly in autumn; the cold dew winds come early; and their probability of occurrence is fairly high. This means that the problem of safe full heading of the late rice crop must be taken into consideration.

Few hours of sunlight and substantial variations in daily temperatures: Western Hunan has numerous mountains and large numbers of clouds, so it gets less sunshine than other regions. The region gets between 1,273 and 1,642 hours of sunshine each year, most of it during July and August. Over the

years, Jishou has averaged 1,345 hours of sunshine, Dayong 1,528 hours, and Huayuan 1,312 hours versus 1,771 hours for Changde, 1,849 hours for Yueyang, and 1,803 hours for Xiangyin. The sunny day rate for the western Hunan region ranges from 30 to 37 percent, and total radiation ranges from 91.2 to 104.0 kilocalories per square centimeter per year, generally decreasing from east to west. Between April and October, the average daily temperature variation is greater than 8.2°C, and between July and October the average daily temperature variation at Dongkou reaches more than 18°C. April through October is the period when paddy rice, cotton, and fruits grow and ripen, and great variations in daily temperatures are beneficial to these crops' accumulation of fiber.

Marked vertical temperature change, seasonal changes becoming greater with elevation: Vertical temperature changes are marked in western Hunan. Generally speaking, the variation in temperature for each 100 meter rise in elevation is the same as for each degree of latitude. Take, for example, the Shimen County Meteorology Station (N 29°40' and 80.2 meters above sea level) and the Dongshanfeng Meteorology Station (N 29°51' and 1,461 meters above sea level), a difference of 1,370.8 meters in elevation. However, the temperature variation between the two stations is as though the one at the higher elevation were at N 13°46'. Shimen's temperature is like that of the intermediate sub-tropics, while Dongshanfeng's is like that of Changchun. Between 500 and 800 meters, the frost-free period is 250-260 days, between 11 and 32 days less than below 500 meters. Temperature climbs back early, but rises slowly. Above 800 meters, the frost-free period is about 230 days. In early spring, warmth returns slowly and during both spring and fall cold currents are strong making the growing season short. These things affect crop growth and planning. Marked changes in vertical temperature variations have been beneficial to the southward movement of living things from the north. Within the region, between 500 and 600 kinds of medicinal herbs from the north have moved southward.

(2) Atmospheric Temperature and Development of Two Paddy Crops

Proper time for sowing early rice: Choosing the right time for sowing early rice requires consideration of when weather conditions will favor the sowing and sprouting of early rice so as to avoid seedling rot. It also requires consideration of the young panicle differentiation, heading, and flowering periods so as to avoid damage from low temperatures. In addition, it requires consideration of whether the late rice crop in a double crop system will be able to come into full head safely before the arrival of the cold dew winds. The main danger in sowing and sprouting of the early rice crop, and the cause of seedling rot is cold waves. The pattern of cold wave occurrence is generally the same in this region as elsewhere in the province. During late March and early April, cold waves are frequent and strong. After mid-April the frequency of cold waves diminishes, their intensity weakens, and they endure for shorter periods of time. During mid and late March, cold waves take place mostly between the 14th and the 23rd, and between the 28th and the 31st. During early April they occur mostly between the 2nd and the 5th, and between the 9th and the 11th. The best time for the sowing and sprouting of early rice is when daily temperature averages more than 11°C for

3 consecutive days (figured in conjunction with the Provincial Meteorology Bureau-determined best sowing and sprouting time for early rice of more than 5 consecutive days of daily temperatures averaging more than 11°C). Probabilities for favorable weather for the sowing and sprouting of rice in western Hunan during late March and early April are shown in the following table (Table 104):

Table 104. Probability of Favorable Weather for the Sowing and Sprouting of Early Rice During Late March and Early April in the Western Hunan Region

(a) 地点	(b) 早稻播种出苗有利天气出现的机率（%）		(c) 日平均气温稳定在10℃以上出现的累计机率（%）	
	(d)三月下旬	(e)四月上旬	(d)三月下旬	(e)四月上旬
(f) 靖县	72	86	14	100
(g) 芷江	60	92	18	100
(h) 沅陵	64	82	45	100
(i) 吉首	62	82	39	100
(j) 大庸	73	80	45	100
(k) 武冈	78	95	20	100

Key:
- a. Location
- b. Probability (%) of favorable weather for the sowing and sprouting of early rice
- c. Cumulative probability (%) of average daily temperature stabilized at above 10°C
- d. Last 10 days of March
- e. First 10 days of April
- f. Jingxian
- g. Zhijiang
- h. Yuanling
- i. Jishou
- j. Dayong
- k. Wugang

The foregoing table shows that for all parts of the western Hunan region, around Qingming [5 April] the probability that favorable weather for the sowing and sprouting of rice will occur is greater than 80 percent. By early April, the cumulative probability that daily average temperature will stabilize above 10°C reaches 100 percent. Thus, a rush to plant should be made at the tail end of the cold weather and the beginning of the warm at the end of March and the beginning of April. The lower temperature limit for the differentiation of young rice panicles is when daily temperature averages less than 17°C. The lower temperature limit for heading and flowering is when daily temperature averages less than 20°C. Temperatures equal to or less than 20°C for more than 5 consecutive days will hurt early rice heading and flowering. Probabilities for the occurrence of average daily temperatures

equal to or less than 17°C and equal to or less than 20°C for each 10-day period during May and June in the western Hunan region are shown in the following table (Table 105):

Table 105. Probability (%) of Occurrence of Temperatures of Less Than 17°C and Less Than 20°C for More Than 5 Consecutive Days During May and June in the Western Hunan Region

(a) 地点	(b) 日平均温低于17℃持续五天以上出现机率			(c) 日平均温低于20℃持续五天以上出现机率			(d) 资料年代
	(e) 五月中旬	(f) 五月下旬	(g) 六月上旬	(e) 五月中旬	(f) 六月上旬	(g) 六月中旬	
(h) 靖县	0	0	0	6	0	0	1962—1975
(i) 芷江	9	0	0	23	0	0	1954—1975
(j) 沅陵	13	0	0	35	0	0	1956—1975
(k) 吉首	6	0	0	16	0	0	1952—1975
(l) 花垣	0	0	0	24	0	0	1956—1975
(m) 大庸	0	0	0	6	0	0	1957—1974
(n) 龙山	0	0	0	24	0	0	1959—1975
(o) 桑植	0	0	0	17	0	0	1958—1975
(p) 慈利	5	0	0	11	0	0	1957—1975
(q) 隆回	5	0	0	16	0	0	1957—1975
(r) 武冈	10	0	0	20	0	0	1955—1974

Key:

a. Location
b. Probability of average daily temperature of less than 17°C for 5 consecutive days
c. Probability of average daily temperature of less than 20°C for 5 consecutive days
d. Years of data
e. Middle 10 days of May
f. Last 10 days of May
g. First 10 days of June
h. Jingxian
i. Zhijiang
j. Yuanling
k. Jishou
l. Huayuan
m. Dayong
n. Longshan
o. Sangzhi
p. Cili
q. Longhui
r. Wugang

The foregoing table shows the following: (1) The probability that low temperature weather will occur during the middle 10 days of May with average daily temperatures as low as 17°C prevailing for more than 5 consecutive days is less than 13 percent. During the last 10 days of May throughout western Hunan there are no occurrences of average daily temperatures as low as 17°C prevailing for 5 consecutive days. (2) The probability of temperatures lower than 20°C occurring for more than 5 consecutive days during the last 10 days of May is more than 23 percent for Longshan, Huayuan, Yuanling, and Zhijiang, and less than 20 percent for Sangzhi, Dayong, Cili, Jishou, Longhui, Jingxian, and Wugang. After the first 10 days of June, there are no periods of 5 days or more when daily temperatures average less than 20°C.

It takes approximately 58 days for early ripening varieties of early rice in a two rice crop system from the time of sowing until the differentiation of young panicles. It takes about 76 days until heading and flowering. For intermediate ripening varieties of early rice in a two crop system, it takes about 65 days from the time of sowing until the differentiation of young panicles, and it takes about 84 days until heading and the beginning of flowering. A look at the biological characteristics of different varieties of early rice in a two crop system in conjunction with weather conditions shows that for the western Hunan region the period between the end of March and the first 10 days of April is the clear weather time for getting in on the end of cold weather and the beginning of warm weather to plant medium-late maturing varieties. The period from the last 10 days of March until around Qingming [5 April] is when early maturing varieties should be put into the ground. This makes possible fullest use of temperature so that the period of development of different varieties falls during favorable meteorological conditions. In particular, the heading and flowering period does not take place during the last 10 days of May when daily temperatures average less than 20°C for 5 consecutive days. Instead, heading and flowering occur when there is plenty of sunshine and there are great daily temperature variations, and ripening occurs before autumn.

Safe full heading of late rice in a double crop system: The full period of development of late rice in a double crop system occurs during the transition from high temperatures to low temperatures. During this time, probabilities are small that low temperatures will occur during the booting stage, but danger from low temperatures is great during the heading and flowering stage. During September and October, cold and warm weather alternate and the sub-tropical high pressure that affects the western Hunan region begins to weaken as cold air from the north advances steadily southward. Since the topography of the western Hunan region is relatively high, autumn temperatures descend rapidly, frequently resulting in an abrupt temperature decline and continuous rainy, overcast weather. Such weather is extraordinarily bad for the flowering and pollination of paddy rice, and frequently much of the rice aborts or no crop is harvested. When average daily temperatures are equal to or less than 20°C for 3 days or more, or when average daily temperatures are equal to or less than 20°C for 2 days or more, with temperatures falling to 17°C for one day, both xian and geng rice varieties of late rice in a double crop system are damaged. A table showing the guarantee rate for safe full heading during different periods for late rice in a double crop system in western Hunan shows the safe heading period for late rice in a double crop system in western Hunan tends to be early. A guaranteed safe heading rate of more than 80 percent after 20 September applies only to Longhui. For Dayong, Cili, Huayuan, Jingxian, and Xinhua, it is before 15 September; for Jishou, Yuanling, Zhijiang, Xupu, and Wugang, it is between 20 and 25 September. For Longshan, it is before 10 September. (Table 106)

Table 106. Guarantee Rate (%) for Safe Full Heading at Different Periods in Various Parts of Western Hunan

(a) 地点	(b) 保证日保证率			(c) 寒露风 (1)		(f) 资料年代
	90%	80%	50%	(d) 最早出现日	(e) 最迟出现日	
(g) 靖县	6/9	11/9	16/9	3/9 (1972)	12/10 (1975)	1962—75
(h) 芷江	11/9	16/9	26/9	2/9 (1972)	12/10 (1975)	1954—75
(i) 沅陵	11/9	16/9	26/9	3/9 (1972)	11/10 (1975)	1955—75
(j) 吉首	11/9	16/9	26/9	3/9 (1972)	4/10 (1961.66)	1957—75
(k) 花垣	10/9	11/9	18/9	3/9 (1972)	5/10 (1962)	1955—75
(l) 大庸	8/9	12/9	18/9	3/9 (1972)	13/10 (1967)	1957—74
(m) 龙山	5/9	9/9	18/9	3/9 (1972)	5/10 (1962)	1959—75
(n) 慈利	9/9	12/9	22/9	3/9 (1972)	14/10 (1962.63)	1957—75
(o) 溆浦	10/9	17/9	27/9	3/9 (1972)	7/10 (1955)	1955—75
(p) 隆回	17/9	22/9	27/9	11/9 (1962)	17/10 (1964)	1957—75
(q) 新化	6/9	14/9	24/9	3/9 (1972)	6/10 (1966)	1957—74
(r) 武冈	16/9	19/9	27/9	11/9 (1967)	11/10 (1966)	1955—74
(s) 吉卫			3/9	23/8 (1974)	13/9 (1975)	1972—75

(1) By cold dew winds is meant an average daily temperature of 20°C or less for more than 3 consecutive days or of 20°C or less for more than 2 days on 1 day of which the average daily temperature is 17°C or less.

Key:

a. Location
b. Guaranteed days guarantee rate
c. Cold dew winds (1)
d. Earliest day of occurrence
e. Latest day of occurrence
f. Data years
g. Jingxian
h. Zhijiang
i. Yuanling
j. Jishou
k. Huayuan
l. Dayong
m. Longshan
n. Cili
o. Xupu
p. Longhui
q. Xinhua
r. Wugang
s. Jiwei

The foregoing presents the guarantee rate of different dates for safe full heading that have been worked out for conventional varieties of paddy planted as a late crop; they do not apply to hybrid rice varieties. This is because hybrid rice varieties cannot tolerate high temperatures or withstand low temperatures during their heading periods. Results of comparative observations of meteorology during the booting and flowering stages, and of panicle growth and fruiting rates for early, intermediate and late hybrid rice conducted in 1976 by the Hunan Provincial Rice Institute confirm that an average daily temperature equal to or greater than 30°C for any 11 or more of 15 consecutive days is a high temperature criterion for

safe full heading of intermediate hybrid paddy rice (Nanyou No 2). An average daily temperature of less than 23°C for 4 consecutive days is a low temperature criterion for safe full heading of late hybrid paddy rice (Nanyou No 2). On the basis of these two criteria, meteorological data from some meteorological observatories and stations in the western Hunan region have been used to propose safe heading periods for intermediate hybrid rice and for late hybrid rice. These data are provided for reference below (Table 107 and Table 108):

Table 107. Safe Full Heading Period for Intermediate Hybrid Rice in the Western Hunan Region

(a) 站名	(h) 高温危害年份及其出现时数					(i) 次数	(j) 频率	(k) 安全齐穗保证率	(l) 安全齐穗有80%以上的保证率的日期	(m) 资料年代及年数
	(n) 七月上旬	(o) 七月中旬	(p) 七月下旬	(q) 八月上旬	(r) 八月中旬		(%)	(%)		
(b) 慈利	59、64	61、62 66、67	76		69	8	40	60	(s) 7月13日	1957—1976 共20年 (t)
(c) 大庸	64	62、66 71				4	20	80		1957—1976 共20年
(d) 沅陵				66	58	2	9	91		1954—1975 共22年 (u)
(e) 芷江						0	0	100		1951—1975 共25年 (v)
(f) 靖县						0	0	100		1962—1976 共15年 (w)
(g) 隆回	64	62、67	66		63	5	26.3	73.7	(y) 8月19日	1957—1975 共19年 (x)

High temperature danger criterion: When average daily temperature is equal to or greater than 30°C during any 11 days during a consecutive 15-day period.

Key:

a. Name of station
b. Cili
c. Dayong
d. Yuanling
e. Zhijiang
f. Jingxian
g. Longhui
h. Years of danger from high temperatures and times of occurrence
i. Number of times
j. Frequency (%)
k. Guarantee rate for safe full heading (%)
l. Dates when guarantee rate for safe heading is greater than 80 percent
m. Data dates and number of years
n. First 10 days of July
o. Middle 10 days of July
p. Last 10 days of July
q. First 10 days of August
r. Middle 10 days of August
s. 13 July
t. Total of 20 years
u. Total of 22 years
v. Total of 25 years
w. Total of 15 years
x. Total of 19 years
y. 19 August

Table 108. Safe Full Heading Period for Late Hybrid Paddy in the Western Hunan Region

(a) 站名	(h) 低温危害始日出现时数 九月上旬 (k) (o) 次数	(p) 频率	九月中旬 (l) (o) 次数	(p) 频率	九月下旬 (m) (o) 次数	(p) 频率	十月 (n) (o) 次数	(p) 频率	(i) 安全齐穗有80%或以上的保证率日期	(j) 资料年代及年数
(b) 慈利	9	45%	8	40%	2	10%	1	5%	(q) 9月7日	1957—1976 共20年 (u)
(c) 大庸	8	40%	10	50%	2	10%			(r) 9月9日	1957—1976 共20年
(d) 沅陵	7	31.9%	8	36.3%	5	22.7%	2	9.3%	9月9日	1954—1975 共22年 (v)
(e) 芷江	5	20%	12	48%	7	28%	1	4%	(s) 9月10日	1951—1975 共25年 (w)
(f) 靖县	4	26.6%	6	40%	3	20%	2	13.3%	(t) 9月6日	1962—1976 共15年 (x)
(g) 隆回	4	21%	8	42%	5	26.3%	2	10.5%	9月10日	1957—1975 共19年 (y)

Note: 1. Low temperature danger criterion: Average daily temperatures lower than 23°C for 4 consecutive days or more.
2. A low temperature danger guarantee rate that is greater than 80 percent is a safe heading period.

Key:
a. Name of station
b. Cili
c. Dayong
d. Yuanling
e. Zhijiang
f. Jingxian
g. Longhui
h. Beginning dates for low temperature danger and times of occurrence
i. Dates when guarantee rate for safe full heading is 80 percent or above
j. Data dates and number of years
k. First 10 days of September
l. Middle 10 days of September
m. Last 10 days of September
n. October
o. Number of times
p. Frequency
q. 7 September
r. 9 September
s. 10 September
t. 6 September
u. Total of 20 years
v. Total of 22 years
w. Total of 25 years
x. Total of 15 years
y. Total of 19 years

Extent of development of double crops of rice: In the western Hunan mountain region, the effects of vertical temperature changes on development of two crops of rice are great. (Table 109)

Table 109. Comparison of Average Daily Temperatures, Cumulative Temperatures Equal to or Greater Than 10°C, Safe Full Heading Periods, and Numbers of Hours of Sunshine

	项 (a) 目	沅 (g) 陵	花 (h) 垣	龙 (i) 山	吉 (j) 卫	(k) 纬度相近的花垣与吉卫比较
(b)	海拔高度(米)	143	342	486	820	
(c)	多年年平均温(℃)	16.5	16.1	15.9	13.4	吉卫比花垣低2.7℃ (l)
(d)	≥10℃积温	5217	5070	5025	4332	吉卫比花垣少738℃ (m)
(e)	常规水稻安全齐穗期(日/月)	16/9	11/9	9/9	3/9(1)	
(f)	5—10月日照时数(小时)	1064	920	771	692	

Note: Safe full heading for 3 September can be only 50 percent guaranteed.

Key:

a. Particulars
b. Meters above sea level
c. Average annual temperature for many years (°C)
d. Cumulative temperature when temperature is equal to or greater than 10°C
e. Safe full heading period (day/month) for conventional rice
f. Number of hours of sunshine between May and October
g. Yuanling
h. Huayuan
i. Longshan
j. Jiwei
k. Comparison of Huayuan and Jiwei at similar latitudes
l. Jiwei 2.7°C lower than Huayuan
m. 738°C less for Jiwei than for Huayuan

This table shows that no matter the average annual temperature for many years or the cumulative temperature when the temperature is equal to or greater than 10°C, both the safe full heading period for late conventional variety rice in a two-crop system and the number of hours of sunshine show a pattern of marked decline as elevation above sea level rises.

1. A safe full heading date of 9 September for late conventional rice in a double crop system at Longshan, which is nearly 500 meters above sea level is a little early. The growing of two crops of rice requires tight scheduling. The guarantee rate for safe full heading by 3 September at Jiwei in Huayuan County, which is 820 meters above sea level is only 50 percent, and the growing of double crops of rice poses more difficulties. In April, the average temperature at Jiwei is 13.9°C. This is 1.1°-2.0°C degrees lower than the 15.0°-15.9°C temperature needed during the period of winter wheat spike formation and flowering. In May, the temperature averages 17.5°C, which is 3.5°-3.9°C less than the temperature required for winter wheat to

mature. Clearly the temperatures are somewhat low for winter wheat to spike, flower, and mature.

2. The cumulative temperature required for the growing of two crops of rice when the temperature is equal to or greater than 10°C is 4,700° to 5,300°C. At Longshan, where the elevation above sea level is close to 500 meters, the cumulative temperature is only 5,025°C, which is somewhat low. In Jiwei at 820 meters, the cumulative temperature is only 4,332°C, insufficient to meet needs in growing two crops of rice.

3. The number of hours of sunshine between May and October at Long Shan, which is close to 500 meters above sea level, is 771. This is 293 hours fewer than at Dayong, which is 143 meters above sea level. The number of hours of sunshine at more than 500 meters above sea level does not permit increase in output by growing two crops of rice. At 800 meters above sea level, Jiwei receives only 692 hours of sunshine between May and October, making it even less possible to increase output by growing two crops of rice.

In addition is the effect of ecological differences on a single variety. For each 100 meter rise in elevation above sea level, the maturation period is delayed by from 4 to 6 days.

In view of the foregoing, places higher than 500 meters above sea level should not grow two crops of rice. April and May temperatures are also a little too low for the growing of winter wheat. However, because of differences in the micro-topography, differences in heat conditions exist at the same altitudes.

4. Moisture Resources and Water Conservancy Construction

(1) Abundant Moisture Resources

The annual amount of precipitation is plentiful, and the annual amount of evaporation is slight. In most years, western Hunan receives an average 1,300-1,450 millimeters of precipitation. Two of the province's centers of heavy rainfall are in this region. The area around Anhua receives more than 1,800 millimeters of precipitation annually, and Wudaoshui and Liangshuikou on the Li Shui receive more than 1,800 millimeters. In most years the average amount of precipitation decreases from east to west with the Baojing and Anjiang area receiving 1,400 millimeters, the area west of a line from Zhijiang and Huitong receiving 1,300 millimeters, and Xinhuang receiving 1,192 millimeters. The amount of evaporation is slight because of the high elevation of the terrain and low temperatures. Annual precipitation is greater than annual evaporation (Table 110). Air humidity is fairly high, and this favors the growing of Chinese fir, tea, and corn. Western Hunan has about 90 billion cubic meters of surface water or 50 percent of the average amount of 180.7 billion for the province in most years. The annual amount of precipitation satisfies agriculture's needs for water. A very great potential exists for agricultural water conservancy to make full use of surface water.

Table 110. Comparison of Annual Precipitation and Annual Evaporation (Units: millimeters)

项 (a) 目	大(e)庸	花(f)垣	沅(g)陵	芷(h)江	武(i)冈	新(j)化
(b)年降水量	1391	1482	1524	1326	1492	1445
(c)年蒸发量	1303	1178	1222	1300	1191	1331
(d)年降水量大于蒸发量	88	304	302	26	301	114

Key:

a. Particulars
b. Annual amount of precipitation
c. Annual amount of evaporation
d. Annual increase in precipitation over evaporation
e. Dayong
f. Huayuan
g. Yuanling
h. Zhijiang
i. Wugang
j. Xinhua

A dense river network and large volume of flow in streams: An overwhelming majority or parts of the Yuan Shui, the Li Shui, and the Zi Shui, which help form the four major water systems in the province are found in the western Hunan region. The Yuan, Li, and Zi rivers have more than 3,000 tributaries large and small. The mountains are high, so the rivers are long, and the river network is dense. The rivers are replenished largely through rainfall, and the average annual volume of flow is substantial. Silt content is slight; the water has a neutral pH, and the rivers are a fine source of water for industry, agriculture, and the daily lives of the people.

Ground water is plentiful, and the area of abundant water widespread. In the western Hunan region, carbonate rocks, particularly limestone, are found mostly in the northwest and on the southeastern side of the Xuefeng Shan in the middle reaches of the Zi Shui. Mostly they are thick layers of limestone that are relatively pure and whose chemical composition is fairly stable. They dissolve readily, are easily corroded, and contain abundant water. In addition, rainfall is copious; the terrain is precipitous; river valleys are deep; conditions for underground runoff are good; and the role of hydrological alternation is strong. This favors ground water runoff and drainage. The northern part of the western Hunan region is an abundant water area where karst water predominates. Structural faulting is developed and folding is frequent creating a structural line running NNE by SSW. Karst faulting is markedly developed. Underground river karst caverns following a general northeast direction converge with structural lines. As a result of the powerful upheaval of new diastrophic movements, intermittent uplifting has taken place forming exposed karst areas characterized by multi-layer karst development. The form that karst water movement takes is primarily controlled flow, with most ground water appearing in the form of subterranean rivers and large springs. There are numerous subterranean streams and beheaded rivers, 44 of them throughout the province and 21 of them, or 47 percent, in this region. The volume of water carried by underground rivers and springs is substantial. For example, the flow at Dalongdong in Jishou

is 3.16 cubic meters per second; at Yingtaoao in Fenghuang, it is 8.9 cubic meters per second; and at Libiqi and Yongshunguanba in Shuangzhi, it is 9.7 cubic meters per second. The volume of flow of the Kapeng underground river in Baojing is 2,600-3,456,000 tons per day and night. The eastern side of Xuefeng Shan is also an abundant water area in which karst water predominates. New structural movement has caused slight uplifting; naked karst runs northwestward for a great distance, and there is considerable covered karst as well. The form of karst water movement is both controlled flow underground and emergence through cracks. Mostly the water emerges as springs, and there are relatively few underground rivers. One fairly large one is Longcongqiao in Wugang with a flow of 5 cubic meters per second; another is Piaoping in Dongkou with a flow of 1,000-432,000 tons per day and night. The Xuefeng Shan area in the southwestern part of the western Hunan region is a water-poor area whose water comes mostly from fissures. On the other hand, Chenxi, Huaihua, and Xupu are areas rich in karst water. The karst water of the western Hunan region is fresh water of neutral pH and low mineral content. Its temperature ranges from 16-22°C, and it does not lie very far beneath the surface. It is the principal source of water for industrial and agricultural use.

The western Hunan region also has abundant underground thermal water resources. More than 40 percent of the province's 72 hot water sites are in this region, more than 70 percent of them being in the northwestern part of the western Hunan region. Western Hunan has one high temperature (60°-100°C) spring, 11 medium temperature (40°-60°C) springs, and 20 low temperature (20°-40°C) springs. These hot springs hold great potential for use. (Figure 58)

(2) Low Certainty Rate for Agricultural Use of Water

Summer and autumn drought occur frequently, and continuous summer and autumn drought are most serious. Between 1956 and 1973, the autonomous zhou had a 25.5 percent instance of summer drought and a 28.7 percent instance of autumn drought for a total 54.2 percent instance. Continuous summer and autumn drought occurred 5.2 percent of the time. Drought occurs mostly from June through September. During 1972, no soaking rain fell from early June until late September throughout the zhou, the drought lasting from 65 to 80 days. Statistics from Huayuan, Fenghuang, Baojing, and Guzhang counties showed 154 out of 190 reservoirs (including small secondary ones) as having dried up. In the mountains, 2,972 out of 3,060 ponds dried up, and 275 out of 371 streams stopped flowing. This was 82, 97 and 74 percent of the total number of reservoirs, ponds, and streams. Grain output throughout the zhou fell by more than 300 million jin. Between 1951 and 1972, Qianyang Prefecture experienced severe summer or autumn drought in 1955, 1957, 1959, 1960, 1964, and 1972 for a 30 percent probability rate, a major summer or autumn drought occurring once every 3 years. Probability of autumn drought is greater than summer drought. During the 18-year period between 1958 and 1975, southern and central Qianyang Prefecture had an autumn drought for 15 to 16 years. Since 1950, Xinning, Wugang, Dongkou, and Longhui counties in the upper reaches of the Zi Shui on the southeastern side of Xuefeng Shan had droughts lasting for more than 60 consecutive days in 1954, 1956, 1959,

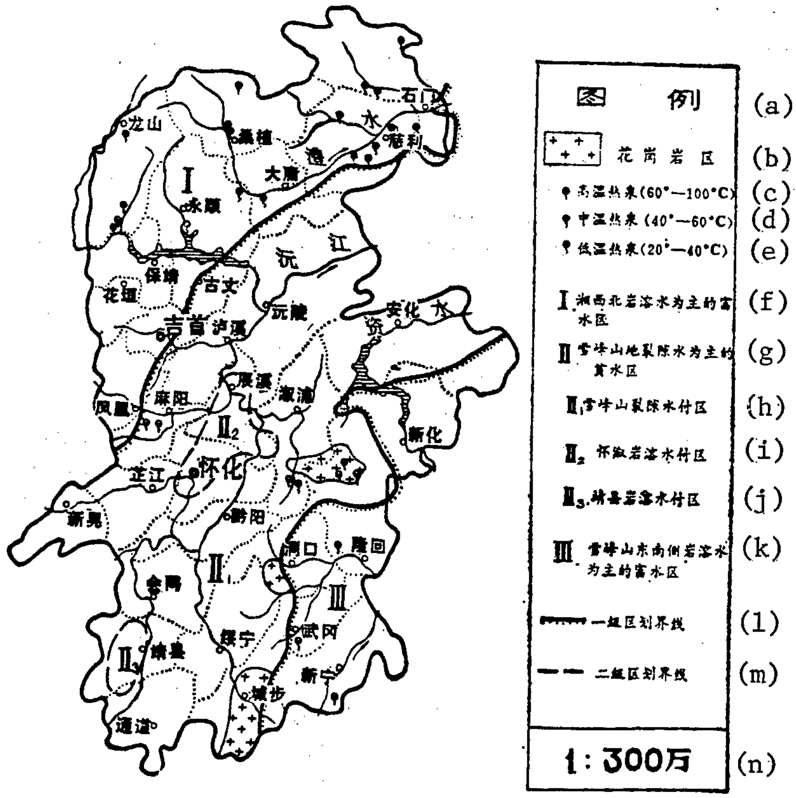


Figure 58. Map Showing Distribution of Ground Water and Underground Hot Water in the Western Hunan Agricultural Region

Key:

- a. Legend
- b. Granite rock region
- c. High temperature hot water (60°-100°C)
- d. Medium temperature hot water (40°-60°C)
- e. Low temperature hot water (20°-40°C)
- f. I. Abundant water area of northwestern Hunan with predominantly karst water
- g. II. Water-poor region of Xuefeng Shan where water from fissures predominates
- h. II_1. Xuefeng Shan fissure water sub-area
- i. II_2. Huaihua-Xupu karst water sub-area
- j. II_3. Jingxian karst water sub-area
- k. III. Southeastern side of Xuefeng Shan abundant water area where karst water predominates
- l. Primary district demarcation line
- m. Secondary district demarcation line
- n. 1:3,000,000

1960, 1964, and 1972. The droughts of 1959, 1960, and 1972 lasted for more than 90 days. Probability of occurrence of severe or particularly severe drought was 26 percent. A Longhui County water conservancy survey showed that because of the lack of water conservancy facilities, 78 million people had to be used during the past 15 years to fight drought. This was four times the 19 million required for places having water conservancy facilities, and their use seriously hurt increases in agricultural production.

Little rain falls between July and September, and it is not very effectively used. It is between July and September that the early rice crop is in the milk ripe stage, and the late rice crop goes from transplanting to heading, flowering, and the in-the-milk stage consuming a total of 497.6 millimeters of water or an average of more than 6 millimeters per day. The following Table 111 shows that over the years average rainfall between July and September has been unable to supply the water needs of growing rice during the same period.

Table 111. Amount of Evaporation Greater Than Amount of Precipitation Between July and September in the Western Hunan Region

	项 (a) 目	凤 (e) 凰	泸 (f) 溪	芷 (g) 江	隆 (h) 回	通 (i) 道	大 (j) 庸
(b)	降 水 量 mm	358.8	343.8	324.4	261	354.2	485.0
(c)	蒸 发 量 mm	445.1	588.6	515	602	530.4	564.8
(d)	蒸发量大于降水量的%	24%	71%	88%	130%	49%	16%

Key:

a. Particulars
b. Amount of precipitation (mm)
c. Amount of evaporation (mm)
d. Percentage by which evaporation is greater than precipitation
e. Fenghuang
f. Luxi
g. Zhijiang
h. Longhui
i. Tongdao
j. Dayong

In addition, between July and September the amount of evaporation is generally greater than the amount of precipitation, and this further reduces the amount of water available for rice growth. During July and August, most of the rainfall everywhere is in the form of local thunderstorms that bring benefit to only small areas. Furthermore, the rain often falls in torrents and runs off quickly, so its effectiveness is slight. Sometimes no rain falls for a long time, the amount is small, and usefulness even less.

Great changes in water sources, low certainty of water for agricultural use: Precipitation varies greatly in western Hunan, and the certainty of precipitation is low. Over the years, there has been a disparity in the amount of precipitation during any given month. During the same month, minimum rainfall has been only 1.6 to 1.9 percent of maximum. Usually minimum has been less than 10 percent of maximum. A look at the change in rainfall from July through September in the western Hunan region (Table 112) shows the

amount of rainfall during this period to have been able to assure less than 25 percent and no more than 40 percent of needs for water during this same period. Over the years, the minimum value for volume of rainfall between July and September has been 118.4 millimeters. In most years, less than 170 millimeters has fallen during this period, Jishou and Jingxian counties alone receiving more than 200 millimeters. This is an insufficient amount of water to meet rice growth needs, and the certainty of having water for agricultural use is low.

Table 112. Changes in Precipitation From July Through September in the Western Hunan Region

	项目 (a)	靖县 (f)	芷江 (g)	沅陵 (h)	吉首 (i)	大庸 (j)	安化 (k)	溆浦 (l)	隆回 (m)	武冈 (n)
(b)	7—9降水量 mm	341	378.4	404.5	419.5	427.2	444.7	283.7	261	306
(c)	7—9月降水量最少值 mm	221.6	159	166.1	233	139.1	163.7	118.4	118.4	161.4
(d)	7—9月降水量最少值占历年同期降水量的%	64.8	47.9	41.1	55.6	32.8	36.7	41.8	41.5	53
(e)	7—9月降水量能满足水稻生产需水量年分的保证率%	14	14	24	39	22	40	5	7.1	5

Key:

a. Particulars
b. Millimeters of rainfall from July through September (mm)
c. Minimum rainfall value from July through September (mm)
d. Minimum rainfall value from July through September as a percentage of precipitation for the same period over the years
e. Certainty (%) that July through September rainfall will be able to satisfy annual needs for rice production
f. Jingxian
g. Zhijiang
h. Yuanling
i. Jishou
j. Dayong
k. Anhua
l. Xupu
m. Longhui
n. Wugang

Since streams depend primarily on rainfall for replenishment, the volume of flow in streams changes greatly with changes in the amount of precipitation, the vastness of mountainlands, the vertical slope of riverbeds, the speed of the current, the concentration of runoff, and the suddenness of rise and fall of floodwaters (Table 113). In 1972, 657 of the 995 streams in the autonomous zhou stopped flowing. This was 66 percent of all streams. Certainty of being able to supply water for agriculture was very low. Only by using the impounding of water as the foundation supplemented with diversion and lifting of water could there be any guarantee.

Table 113. Table Showing Changes in Volume of Flow of Major Rivers in the Western Hunan Region

	(a) 最大流量	(b) 最小流量	最大流量与最小流量相差的倍数 (c)
(d) 沅 水	24,900	185	134
(e) 澧 水	31,600	9	3,511
(f) 资 水	15,500	50	310

Key:
- a. Maximum flow
- b. Minimum flow
- c. Number of times difference between maximum flow and minimum flow
- d. Yuan Shui
- e. Li Shui
- f. Zi Shui

(3) Construction of Water Conservancy Works

Since the founding of the nation, much has been done in building farmland water conservancy projects in the western Hunan region. As of 1979, Qianyang Prefecture was able to impound, divert, and lift a total of 2.162 billion cubic meters of water, and the autonomous region was able to impound, divert, and lift 998 million cubic meters. The areas from which a harvest could be assured despite drought or waterlogging reached 2,118,000 and 1,172,000 mu respectively. This represented a fundamental change from the pre-liberation situation of isolated ponds, isolated dams, and dependence on rainfall for food. Nevertheless, the area from which a crop can be assured despite drought or waterlogging amounts to only 48.2 percent of the region's total cultivated area. The area of distribution is also very uneven, and capabilities to withstand calamities are relatively low. Weakness in water conservancy remains the major contradiction in the speedy development of agriculture in western Hunan. This is because of the following: (1) The foundation in water conservancy was extremely poor up until the time of liberation. Storing water in individual fields was relied upon to withstand drought, and an overwhelming majority of fields simply relied on rainfall. (2) The water is at a lower level than the fields, and cultivated land is dispersed over wide areas. In addition, great changes occur in the amount of precipitation and the volume of stream flow. Water has to be raised to high levels or diverted over great distances. The mountains are high and the slopes steep, so water conservancy construction requires numerous associated structures. The labor and expense of ditch systems and equipment is three to four times that required for the building of dams, and equipment needs are heavy. Numerous cracks follow in the wake of rock blasting, and leakage is a serious problem. The maintenance problem is a heavy one. (3) In the field of irrigation, advanced irrigation methods such as frequent irrigation using shallow water has yet to be adopted, and water needs for double crops of rice cannot be met. With each fairly severe drought, a lean harvest results. At the present time most water conservancy

facilities have not been fully equipped, and they are a long way from meeting designed standards for irrigating the area. In 1974, medium size water conservancy projects, small (type 1) water conservancy projects, and small (type 2) water conservancy projects in Qianyang Prefecture benefited an actual area of 1,094,000 mu, which was only 57 percent of the 1,914,600 mu of the designed irrigation area. In 1974, the actual area benefited by irrigation in the autonomous region was 487,000 mu, which was 41 percent of the 1,072,000 mu designed irrigation area. Clearly a very great potential exists in equipping water conservancy facilities for use.

In order to clarify regional differences in water conservancy construction in western Hunan and determine the emphasis for water conservancy construction in different areas, 12 tracts able to assure a crop despite drought or waterlogging and four drought zones have been delineated and are presented here for consideration.

Tracts able to assure a crop despite drought or waterlogging: More than 70 percent of commune wetlands are able to assure a crop despite drought or waterlogging, and five of the foregoing communes that form a continuous tract have been designated a tract able to assure a crop despite drought or waterlogging. The western Hunan region may be divided as follows: Twelve tracts able to assure a crop despite drought or waterlogging in the middle and lower reaches of the Li Shui and the middle and lower reaches of the Xu Shui. A look at statistics (Table 114) on the basic situation pertaining to tracts able to deliver a crop despite drought or waterlogging in the western Hunan region shows the following five circumstances of the tracts in the western Hunan region that can assure a crop despite drought or waterlogging: (1) The area able to assure a crop despite drought or waterlogging is a large percentage of the wetland area, and drylands are a high percentage of the cultivated land area, with the result that the area able to assure a crop despite drought or waterlogging is a small percentage of the cultivated land area, and the proportion of consistently high yield fields to total cultivated area is low. In farmland capital construction, the building of consistently high yield fields and water conservancy construction to relieve drought are paramount for tracts able to assure crops despite drought or waterlogging in the middle and lower reaches of the Li Shui and in eastern Anhua. (2) The farmland area able to assure crops despite drought or waterlogging is smaller than the double rice crop area, and the farmlands that produce consistently high yields are a small percentage of the cultivated land area. The task for future farmland capital construction is principally improvement in water conservancy conditions and building consistently high yielding farmlands, with tracts that can deliver crops despite drought or waterlogging in central Longhui, central Xinhua, central and northern Dongkou, southern Dongkou, central Wugang, northern Chengbu, and at Fuyi in Xinning. (3) The proportion of the wetlands area devoted to farmlands that can assure crops despite drought or waterlogging, consistently high yield fields, and of double rice crops is about right. However, the percentage of cultivated land area containing consistently high yield fields is small, and the central task in farmland capital construction is to build consistently high yielding farmlands such as a tract able to assure crops despite drought or waterlogging in the middle and lower reaches of the Xu Shui. (4) The percentage

of wetlands devoted to consistently high yielding farmlands and to double crops of rice is low. Improvement of low yield fields and building consistently high yielding fields is the key in farmland capital construction, such as tracts able to produce crops despite drought or waterlogging in southern Xupu or northern Longhui, in the middle reaches of the Qu Shui, and in the middle reaches of the Zhen Shui. Both the area able to assure a crop despite drought or waterlogging and the consistently high yielding farmland area are a larger percentage of the wetland area than that sown to two crops of rice, but drylands are a small percentage of cultivated land area. It is necessary to hasten construction of consistently high yield farmlands such as tracts that can assure a crop despite drought or waterlogging at Anjiang and Hongjiang. (Figure 59)

Table 114. Statistical Table Showing Basic Situation About Tracts That Can Guarantee a Harvest Despite Drought or Waterlogging in the Western Hunan Region

	(a) 名称	(b) 编号	(c) 水田 (f) 面积 (亩)	(g) 旱涝保收所占比重%	(h) 稳高农田所占比重%	(d) 旱土 (f) 面积 (亩)	(i) 占耕地比重%	(e) 耕地 (f) 面积 (亩)	(g) 旱涝保收所占比重%	(h) 稳高农田所占比重%	(j) 旱涝保收农田 (亩)	(k) 高产稳产农田 (亩)	(l) 双季稻 (f) 面积 (亩)	(m) 占水田比重%
(n)	澧水中下游旱涝保收片	1	430519	82	39	279147	36	691366	51	14	356115	96928	343371	79
(o)	沅水中下游旱涝保收片	2	229353	81	56	73809	24	303162	61	42	185992	129303	175891	76
(p)	安化东部旱涝保收片	3	61747	70	49	53764	48	119111	35	26	42340	30644	54805	85
(q)	新化中部旱涝保收片	4	83337	76	57	30094	26	113431	55	42	63396	48260	73450	88
(r)	溆浦南部隆回北部旱涝保收片	5	215770	70	38	57606	21	273370	56	30	152317	83440	85202	46
(s)	洞口中部北部旱涝保收片	6	139145	78	52	37507	21	176652	60	41	106141	73561	115336	80
(t)	隆回中部旱涝保收片	7	44689	74	67	18350	26	63039	53	47	33591	30227	39737	88
(u)	洞口南部武冈中部城步北部旱涝保收片	8	331192	76	53	72071	17	403263	62	44	252888	177901	227996	68
(v)	新宁夫夷水旱涝保收片	9	204205	80	52	90930	27	310620	52	34	163303	106415	163350	79
(w)	安江洪江旱涝保收片	10	107546	70	57	21005	17	128551	59	49	76198	61861	58490	55
(x)	渠水中游旱涝保收片	11	146855	84	30	12253	7	159108	78	27	124293	44294	86512	59
(y)	辰水中游旱涝保收片	12	119461	78	42	24526	10	143987	65	34	94058	50239	69942	79

Key:

a. Name
b. Number
c. Wetlands
d. Drylands
e. Cultivated land
f. Area (mu)
g. Percentage assuring a crop despite drought or waterlogging
h. Percentage of consistently high yield farmland
i. Percentage of cultivated land
j. Farmland able to assure a crop despite drought or waterlogging (mu)

k. Consistently high yield farmland (mu)
l. Double crops of rice
m. Percentage of wetlands
n. Tracts in middle and lower reaches of the Li Shui able to assure a crop despite drought or waterlogging
o. Tracts in middle and lower reaches of the Xu Shui able to assure a crop despite drought or waterlogging
p. Tracts in eastern Anhua able to assure a crop despite drought or waterlogging
q. Tracts in central Xinhua able to assure a crop despite drought or waterlogging
r. Tracts in southern Xupu and northern Longhui able to assure a crop despite drought or waterlogging
s. Tracts in central and northern Dongkou able to assure a crop despite drought or waterlogging
t. Tracts in central Longhui able to assure a crop despite drought or waterlogging
u. Tracts in southern Dongkou, central Wugang, and northern Chengbu able to assure a crop despite drought or waterlogging
v. Tracts in Fuyi, Xinning able to assure a crop despite drought or waterlogging
w. Tracts in Hongjiang, Anjiang able to assure a crop despite drought or waterlogging
x. Tracts in the middle reaches of the Qu Shui able to assure a crop despite drought or waterlogging
y. Tracts in the middle reaches of the Zhen Shui able to assure a crop despite drought or waterlogging

Drought zones: When less than 40 percent of the wetland area of counties is farmland able to produce a crop despite drought or waterlogging, and the frequency of occurrence of severe or particularly severe droughts is low, such counties that form a continuous tract and have weak water conservancy facilities have been designated drought zones. Even though 40 to 60 percent of the wetlands area of a county is able to assure a crop despite drought or waterlogging, if capabilities to withstand severe or particularly severe drought are weak with the result that numerous years are disaster years, such a county is termed a drought zone. Thus four designated drought zones are as follows: the northwestern drought zone, the drought zone in the middle reaches of the Yuan Shui, the drought zone in the middle reaches of the Wu Shui, and the upper reaches of the Zi Shui.

1. The northwestern drought zone: This includes Sangzhi, Longshan, Yongshun, Baojing, and Huayuan counties, which have the following several characteristics:

(1) Frequency of severe and particularly severe drought is low. The extent of summer and autumn drought over the years is as follows: (Table 115)

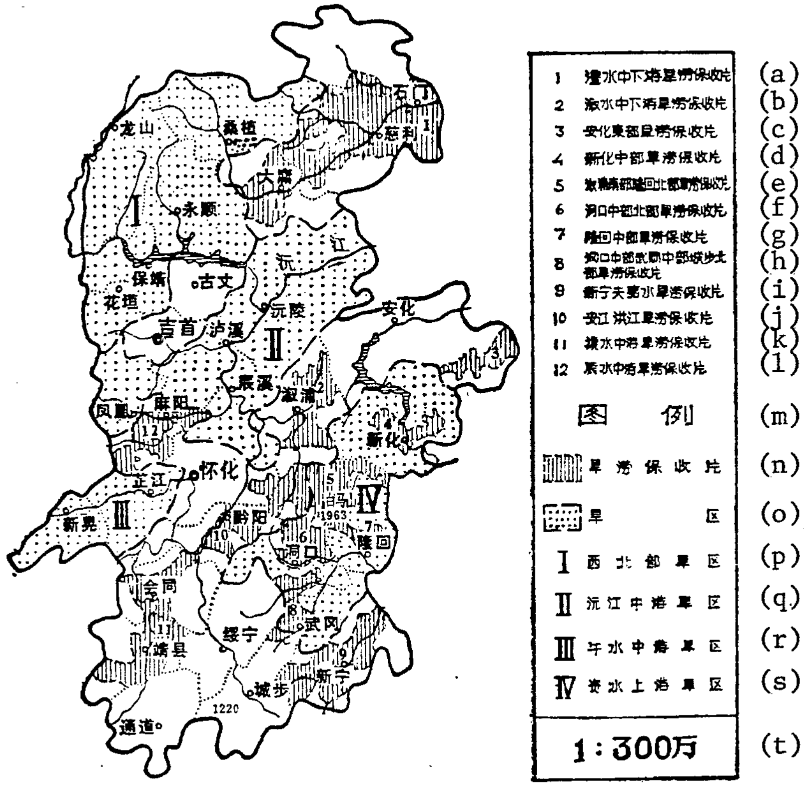


Figure 59. Map Showing Pattern of Tracts Able To Assure a Crop Despite Drought or Waterlogging and Severe Drought Zones in the Western Hunan Agricultural Region

Key:

a. 1. Tract able to assure a crop despite drought or waterlogging in the middle and lower reaches of the Li Shui

b. 2. Tract able to assure a crop despite drought or waterlogging in the middle and lower reaches of the Xu Shui

c. 3. Tract able to assure a crop despite drought or waterlogging in eastern Anhua

d. 4. Tract able to assure a crop despite drought or waterlogging in central Xinhua

e. 5. Tract able to assure a crop despite drought or waterlogging in southern Xupu and northern Longhui

f. 6. Tract able to assure a crop despite drought or waterlogging in central and northern Dongkou

g. 7. Tract able to assure a crop despite drought or waterlogging in central Longhui

h. 8. Tracts able to assure a crop despite drought or waterlogging in central Dongkou, central Wugang, and northern Chengbu

i. 9. Tract able to assure a crop despite drought or waterlogging in Fuyi, Xinning

j. 10. Tracts able to assure a crop despite drought or waterlogging in Anjiang and Hongjiang

k. 11. Tract able to assure a crop despite drought or waterlogging in the middle reaches of the Qu Shui
l. 12. Tract able to assure a crop despite drought or waterlogging in the middle reaches of the Zhen Shui
m. Legend
n. Tract able to assure a crop despite drought or waterlogging
o. Drought zone
p. I Northwest drought zone
q. II Drought zone in middle reaches of the Yuan Jiang
r. III Drought zone in middle reaches of the Wu Shui
s. IV Drought zone in upper reaches of the Zi Shui
t. 1:3,000,000

Table 115. Statistical Table on Summer Drought in the Northwestern Part of the Western Hunan Region

	(a) 县 名	(b) 年 份																	
		56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
(c)	永 顺			0	2	2	1	0	2	1	1	3	0	0	0	1	1	1	0
(d)	花 垣	2	0	0	2	2	1	1	0	1	0	2	0	0	0	0	1	1	0
(e)	保 靖				2	2	1	0	0	1	0	1	0	0	0	0	1	4	0
(f)	桑 植			0	2	0	1	0	1	1	0	1	0	0	0	1	1	4	0
(g)	龙 山				2	2	0	0	0	1	2	0	0	0	0	0	1	1	0

Note: (1) Drought ratings: 0--Normal, less than 19 days; 1--Small drought, 20-29 days; 2--Moderate drought, 30-45 days; 3--Severe drought, 46-59 days; 4--Particularly severe drought, fewer than [sic] 60 days

(2) Summer drought means the period May through August including continuous summer and autumn drought

(3) Source of data: Unpublished draft of "Western Hunan Tujia Nationality and Miao Nationality Autonomous Zhou Meteorology Records"

Key:
a. County
b. Year
c. Yongshun
d. Huayuan
e. Baojing
f. Sangzhi
g. Longshan

(2) The percentage of cultivated land area able to assure a crop despite drought or waterlogging is low. The area able to assure a crop despite drought or waterlogging is only 21.4 percent of the cultivated land area. Eleven percent of the cultivated land area is farmland producing consistently high yields. The task of harnessing water and improving soil is a great one.

(3) In naked karst areas, limestone is widespread, and water leakage is serious. It is really a case of "flood calamity whenever it rains, but drought once the rains have passed." However, karst water is plentiful and potential for its development is great.

(4) Drylands form a large percentage of the cultivated land area, but double crops of rice are grown on a small percentage of the wetland area. The region has 695,403 mu of drylands, which is 39.5 percent of the cultivated land area. Double crops of rice are grown on 17.6 percent of the wetlands area. Since the farmland that is able to assure a crop despite drought or waterlogging is small relative to the total wetland area, capabilities to withstand moderate drought are also weak.

2. The drought zone in the middle reaches of the Yuan Jiang. This includes Fenghuang, Luxi, Yuanling, and Chenxi counties in which severe and particularly severe droughts occur with great frequency once every 4 years. (Table 116) Few fields are able to assure a crop despite drought or waterlogging, approximately only 28 percent of the total cultivated land area. Many fields rely solely on rainfall, 233,000 mu of such fields in Yuanling and Chenxi counties. Both counties have karst mountain areas. Great potential exists for development of surface water and karst water.

Table 116. Statistical Table Showing Extent of Drought Disasters in the Drought Region in the Middle Reaches of the Yuan Shui

	(a) 县名	(b) 年份																	
		56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
(c)	泸溪				2	4	2	2	2	4	1	4	0	1	0	0	1	4	0
(d)	凤凰			0	2	4	1	2	1	1	1	4	0	0	0	0	0	4	0
(e)	沅陵	0	2	0	2	4	1	0	1	3	0	3	0	0	1	2		4	
(f)	辰溪			0	2	3	3	1	2	2	1	2	0	0	1	1		4	

According to unpublished drafts titled, "Qianyang Climate" and "Autonomous Zhou Climatic Records." Drought ratings are the same as in the next previous table.

Key:

a. County
b. Year
c. Luxi
d. Fenghuang
e. Yuanling
f. Chenxi

3. The drought zone in the middle reaches of the Wu Shui. This includes Xinhuang and Zhijiang counties, which have the following characteristics: (Table 117)

(1) Small volume of annual precipitation and great frequency of severe and particularly severe droughts. In most places, annual volume of precipitation is less than 1,300 millimeters. Severe or particularly severe droughts occur once every 4 years.

(2) Uneven development of water conservancy projects, with weak capabilities for withstanding severe or particularly severe droughts. Forty-four percent of the cultivated area in the whole region is able to assure a crop despite drought or waterlogging; for Xinhuang, the percentage is only 20.

(3) In Xinhuang, 33 percent of the cultivated land area is dryland. This is 17 percent more of the cultivated land area than in Zhijiang County.

Table 117. Certainty of Precipitation Volume and of the Occurrence of Severe and Particularly Severe Droughts in the Wu Shui Drought Zone

	(a) 年降水量＞1000mm的保证率	(b) 年降水量＞1200mm的保证率	(c) 大旱特大旱出现周期
(d) 新晃	88%	41%	四年一遇(1959—1975) (f)
(e) 芷江	100%	85%	四年一遇(1951—1975) (g)

Key:

a. Annual volume of precipitation. Certainty of more than 1,000 mm
b. Annual volume of precipitation. Certainty of more than 1,200 mm
c. Cycle of occurrence of severe and particularly severe droughts
d. Xinhuang
e. Zhijiang
f. Once in 4 years (1959-1975)
g. Once in 4 years (1951-1975)

4. The drought zone in the upper reaches of the Zi Shui. This includes Wugang, Dongkou, Longhui, and Xinhua counties, but predominantly the region drained by the Nan Shui. It has the following characteristics:

(1) Serious summer and autumn drought. The drought hits with great force, spreads rapidly, lasts a long time, and covers a wide area. Since 1950, droughts lasting 60 or more consecutive days have occurred in 1954, 1956, 1959, 1960, and 1972. Those of 1959, 1960, and 1972 lasted more than 90 days. In the 43-year period from 1921-1963, Xinhua County had eight severe droughts, 61 moderate droughts, and 11 small droughts. It had a severe or a small drought in 35 years, or in 81 percent of the 43-year period. It had a drought in virtually 8 out of 10 years.

(2) A definite foundation in farmland water conservancy construction already exists, but it is very uneven. The percentage of wetlands growing two crops of rice in this drought zone is the greatest in the western Hunan region.

(3) Water is plentiful. The Nan Shui and the Fuyi Shui provide this region with abundant water. There are also numerous sites suitable for the building of medium size dams. There is also plentiful karst water and resources to be used.

(4) Great Reserves of Water Conservancy Resources

The western Hunan region receives abundant rainfall, and most of the streams flow along fault lines. The rivers exercise powerful cutting action; there are numerous gorges; reefs stand like trees in a forest, and one drop follows another; water power reserves are abundant, accounting for 60 percent of the

whole province's total water power resources (Table 118). The Li Shui, Yuan Shui, and Zi Shui have numerous gorges suitable for the building of numerous dam sites for large and medium size hydroelectric power stations. Wuqiangxi on the Yuan Shui, Tuoxi on the Zi Shui, and Zaoshi on the Li Shui are all good dam sites useful for development of water power resources. For western Hunan, which has "much water and little coal," they provide a plentiful source of power and possess outstanding conditions for serving as hydroelectric power bases for the whole province. Tuoxi Hydropower Station, and Fengtan Hydropower Station, plus Wuqiangxi Hydropower Station, which is still in the planning stage, are all in this region. In 1974, there were more than 4,000 small hydropower station sites with an installed capacity of 85,000 kilowatts. A certain number of small hydropower stations have already been built, thereby providing favorable conditions for the modernization of, and particularly for the mechanization of, agriculture. However, because this region has numerous mountains with great seasonal changes occurring in the volume of flow of its rivers, and low capabilities for guaranteeing sufficient impounding of water during the dry season, reservoirs must be built and the amount of water stored regulated if water power resources are to be effectively used.

Table 118. Table Showing Energy Reserves of Major Streams and Some Tributaries in the Western Hunan Region

		(a) 流域面积 (平方公里)	(b) 河长 (公里)	(c) 落差 (米)	(d) 河口流量 (秒立方米)	(e) 蓄能 (万瓩)	(f) 可能利用的能量的平均蓄能 %	(g) 流域单位面积蓄能 (瓩/平方公里)
(h)	沅水	89,163	1,033	455	2,460	573	79	64
(i)	酉水	18,530	477	658	441	79		39.4
(j)	溆水	3,290	143	361	88	7.3		23
(k)	㵲水	10,334	440	512	258	39.7		61.3
(l)	巫水	4,205	244	485	68	10.8		9
(m)	辰水	754	145	387	204	22.4		30
(n)	龙潭河	1,810	100	200	77.5	4.8		26
(o)	澧水	18,496	388	368	442	139	84	48
(p)	渫水	3,200	165	415	117	14.5		45
(q)	溇水	5,048	250	293	163	20.6		59.5
(r)	资水	28,142	653		804	184	69	51

Note: 1. Energy reserves of the Yuan, Li and Zi rivers means total basin reserves

2. The mainstream of the Yuan Shui has 3.3 million kilowatts of energy reserves; the Zi Shui, 1.22 million kilowatts; and the Li Shui, 530,000 kilowatts

Key:

a. Basin area (square kilometers)
b. Length of river (kilometers)
c. Drop (meters)
d. Volume of flow at mouth (cubic meters per second)
e. Energy reserves (10,000 kilowatts)

f. Average usable energy reserves (%)
g. Reserves per unit of basin area (kilowatts/sq km)
h. Yuan Shui
i. You Shui
j. Xu Shui
k. Wu Shui
l. Wu Shui
m. Chen Shui
n. Longtan He
o. Li Shui
p. Ye Shui
q. Lou Shui
r. Zi Shui

5. Forest and Mineral Resources

(1) Forest Resources

The western Hunan region has vast mountainlands that rise and fall, and forest resources are abundant. The timber forest area covers 28,586,500 mu, which is 42 percent of the province's timber forest area. Timber forest reserves amount to 11,312.91 cubic meters, which is 60.2 percent of the province's total timber reserves. Table 119 shows the various categories of timber reserves.

Table 119. Table Showing Various Kinds of Timber Reserves in the Western Hunan Region and Their Percentage of the Total

	(a) 名称	(b) 蓄积量 (万立方米)	(c) 占全区木材总蓄积量的比重 (%)	(d) 占全省同类木材总蓄积量的比重 (%)
(e)	木材	11312	100	60.2
(f)	其中：杉木	3287	28	54
(g)	马尾松	5778	51	71
(h)	柏木	40	1	67
(i)	阔叶林	2229	20	51

Key:
a. Nomenclature
b. Reserves (10,000 cubic meters)
c. Percentage of region's total timber reserves
d. Percentage of total timber reserves of the same kind in the province
e. Timber
f. Including: China fir
g. Masson pine
h. Cypress
i. Deciduous forests

The region has 2.89 million mu of bamboo forests including 2.64 million mu of nan bamboo, which is 33 percent of the total bamboo forest area for the province. Nan bamboo reserves amount to 287.63 million stalks, which is 32 percent of the province's reserves.

The western Hunan region has abundant sub-tropical and temperate zone tree forest resources. In the two forest regions of Tianping Shan and Badagong Shan in Sangzhi County alone, there are more than 700 kinds of large and small trees in the nearly 80,000 mu of natural forests. There are also large numbers of ancient relic tree varieties. In the wake of the discovery during the early 1940's of living fossil metasequoias in eastern Sichuan and western Hubei, metasequoias were again discovered during the early 1970's at Luota Commune and Tani Commune in Longshan County in this region. The Tianping Shan and Badagong Shan forest regions of Sangzhi County have become a gene pool for a multitude of "living fossil" communities and sub-tropical deciduous woody plants. The Fagus longipetiolata forests and associated ancient coniferous tree species date back at least to the Tertiary Period or the Cretaceous Period. In addition to metasequoias, "relic species" also include ginkgo and Chinese tulip trees. The northern part of this region, eastern Sichuan, and western Hubei together form a preserve of prehistoric relic plants. Preliminary statistics show at least 45 families including some families that are found only here and there in East Asia and North America, plants such as members of the Decaianea farcesii and ginkgo family, the metasequoia family, and the Taiwan fir family. Not only do such relic species have great economic value, but are also of major value in making geological observations and observations about climatic changes. For these reasons, the Tianping Shan forest region, and the Badagong Shan forest region have been designated natural preserves in order to preserve specie stocks. The western Hunan region also has quite a few fine native tree species, most of which are precious. By native species is meant species that are found principally in this region. It has been estimated that Hunan has at least 300 such species, most of them in the western Hunan region. A survey of fine native species for use in afforestation of western Hunan conducted by the Tujia Nationality and Miao Nationality Autonomous Zhou Forest Institute in western Hunan turned up 30 such tree species. Many of them were very fast growing timber trees. Vigorous development of these tree species is an important way in which to hasten the greening of the landscape and solve the timber shortage. Quick growing native timber tree varieties are mostly smooth bark beech [Betula Inminifera], lanlimu [5695 6849 2606], Chinese catalpa, Yunnan catalpa, Chinese toon, Chinese sassafrass, and cryptomeria. In addition, there are numerous valuable timber tree species such as camphor, Phoebe nanmu, hongchou [4767 4848], Keteleeria davidiana, magnolia, Emmenopteris henryi, and various kinds of oaks, most of which are found in the Wuling mountain region. These tree varieties make good large construction materials, and can be used for high quality furniture, for shipbuilding, and to make rolling stock. They are of major value to the national economy and to national defense. Tree species suitable for the afforestation of high mountains are also numerous. One such is the yellow mountain pine [7806 1472 2646], which is found in tracts in the mountain ranges above 800 meters on the Zhangjiajie forest farm in Dayong County. Yellow mountain pine and Keteleeria davidiana are also superior varieties for the afforestation of high mountains.

Western Hunan's oil-bearing woody plant treasure house, tung oil trees, tea oil plants, Chinese tallow trees, and the cubeb litsea tree are also found over a wide area. Survey shows more than 400 species of wild medicinal herbs

such as eucommia bark, official magnolia bark, and songfuling [2646 5415 5376]. Manure and wild forest resources that silkworms use are also plentiful. Coriaria sinica is found widely in northwestern Hunan, and southwestern Hunan has more than 2 million mu of toothed oak forests. Special forest products such as glossy privet [Ligustrum lucidum], the host tree for insect wax, and Chinese sumac, the host tree for Chinese gallnuts, are widespread. Both juicy fruit and dry fruit tree resources as well as deciduous fruit trees and evergreen fruit trees are plentiful. Western Hunan is one of the province's earliest citrus producing areas. Preliminary surveys have uncovered a substantial number of wild citrus resources and semi-cultivated natural hybrid varieties of definite economic value. These provide a material foundation for the breeding of superior cold-resistant varieties and cold-resistant dwarf varieties. The dominant wild oranges growing in the mountainlands in a line running from Shimen and Cili westward along Wuling Shan and Xuefeng Shan and going south are Yichang oranges, fragrant oranges and also trifoliate oranges and Poncirus trifoliata. (Table 120)

Table 120. Wild Orange Resources in the Western Hunan Region

	Characteristics	Principal locations
Yichang oranges	Small bush-like trees that are open and grow vigorously	The autonomous zhou, Qianyang Prefecture, Shimen County, and Cili County
Fragrant oranges	Semi-tree shape, upright, vigorous growth	Shimen, Cili, the autonomous zhou, and the high mountains of Qianyang Prefecture
Trifoliate oranges	Semi-tree like; strong resistance to cold; bushy and rather dwarfed trees	Discovered in 1975 in the high mountains at 1,200 meters above sea level in Yongshun County. Also discovered on Long Shan at 1,300 meters, and on Bamian Shan
Poncirus trifoliata		The autonomous region is the area where the greatest numbers of wild Poncirus trifoliata are found

Other wild fruit tree resources have been little surveyed, and may be plentiful. One example is oily Chinese chestnuts from Longshan, which are large, have a waxy shell, and are light brown in color. There are also numerous kinds of wild chestnuts and walnuts. There is also a considerable amount of grassland, much of it in Chengbu, Suining, Tongdao, Jingxian, Xupu, Luxi, Yongshun, Sangzhi, and Longshan counties, which makes good pastureland for development of animal husbandry. On both banks of the middle and lower reaches of the You Shui, bamao [5359 5403] is widely found. It is a raw material for making paper.

Western Hunan's mountainlands are vast, and they rise and fall greatly. Vertical changes in forest resources are striking. Take Sangzhi County, for example, where there are river valley basins at 300 to 500 meters above sea level, and where evergreen deciduous forests exist outside villages and Himalayan maple, Betula Inminifera, hekenan [7815 3011 2809], and Houzhang [3729 2874] grow. In low mountains at 500-1,000 meters above sea level, and in mountain ravines, mostly secondary growth forests of Betula Inminifera, Chinese sweet gum, muhe [2606 5440], fine leaf poplar [4798 0673 2799], and hornbeam grow. There are two kinds of natural semi-protophytes. The first is ravine evergreen deciduous forests. The second is mountain slope mixed evergreen and broad leaf deciduous forests. On medium size mountains 1,000-1,900 meters above sea level that have gently sloping tops, mixed forests of mostly deciduous trees predominate.

There are two reasons for the western Hunan region's plentiful forest resources. One is that following the Triassic Period, there was no ingression of the sea, and during the Yanshan movement, there was little intrusion of igneous rock; the earth's layers were relatively stable. Together with eastern Sichuan and western Hubei, the western Hunan region was a "sanctuary" during the prehistoric glacial period, and this helped the great development of cover during the Cretaceous Period, and the preservation of modern gymnosperms. Second is the lofty plateaus and the deep river valleys, plus the region's location in the intermediate sub-tropical monsoon region producing mild winters and cool summers, much rainfall and high humidity, great vertical changes and horizontal variations providing a superior geographical environment for development of diverse plants.

Non-productive losses are great in the western Hunan region's forestry production, and the degree to which forest resources are used in multiple ways is low. There are many trees past their prime. This is a problem urgently in need of study for solution. There is a great variation between south and north in benefits from forests. In the mountainlands of the upper reaches of the Yuan Shui, timber reserves average 6.9 cubic meters per mu. In the northern Wuling mountain region, they average only 3 cubic meters per mu, and in the mountainlands in the upper reaches of the Yuan Shui in the south, 21 percent of the existing forestland area is barren mountains. Meanwhile in the northern Wuling mountainlands, barren mountains and cut-over land is 1.5 times the present forest area. A look at results realized from forest regulation of water shows that since the southern forest cover rate is 51 percent while the northern forest cover rate in the Wuling mountain region is 25 percent, the benefits in preventing floods through dispersal of flood crests and the supplementary benefits of water resources in mitigating the low water season are greatest in the south and less in the north, while the erosion modulus is low in the south and high in the north.

(2) Mineral Resources Used for Chemical Fertilizer

Coal mines: The western Hunan region's coal mines are found largely in three areas as follows: One is in the area around Shimen and Cili extending toward Sangzhi. Coal seams are not thick here, being less than 1 meter, and most of the coal has a fairly high ash and sulfur content. The second area

runs from Yuanling through Luxi, Chenxi, and Huaihua to Huitong. Here the thickness of coal seams varies greatly, but is generally 2 to 3 meters, though seams are 17 to 18 meters thick in some places. Yet another place is at Xinhua and Dongkou, possibly extending to Wugang, where the coal seams are fairly thick, and both the ash and sulfur content of the coal is low.

Phosphate rock: Western Hunan is the region of the province with the most plentiful phosphate rock resources, and it is also one of the nation's storehouses of phosphate rock resources. Phosphate rock is found mostly in the region of Dongshan Peak in Shimen and in the area running from Guzhang to Jishou, Luxi, Yuanling, and Huaihua. Phosphate rock resources at Dongshan Peak in Shimen are large, and they are close to the Jiaozuo-Liuzhou Railroad, so transportation is very convenient. These are the phosphate rock resources in Hunan Province holding greatest potential for development. The Guzhang-Jishou-Luxi-Yuanling-Huaihua phosphate mine area runs in a north by east direction and extends intermittently for more than 100 kilometers in length and 60 kilometers in width. The phosphate rock seams are more than 10 meters in depth and the P_2O_5 content is 16-19 percent.

Potash mines: A look at the western Hunan region's potash mines in terms of potash ores that have already been discovered shows potash feldspar most important. This is found principally in the Xuefeng Shan region and the southern Wuling mountain region. Longhui, Dongkou, and Chengbu are major places in the Xuefeng Shan region; and Jishou and Fenghuang are most important in the southern Wuling mountain region. The grade is generally relatively low.

Limestone is found over a wide area of the western Hunan region, and firewood is plentiful so conditions are good for making lime. Gypsum and pyrite are also plentiful.

The western Hunan region has fairly good conditions for development of a chemical fertilizer industry. (1) Chemical mineral resources are abundant, and electric power can be easily supplied. Phosphate rock is the most abundant of chemical ore resources, and raw materials needed for a nitrate fertilizer industry can also be provided from nearby. Within the region, water power resources are abundant, and the potential for hydroelectric power generation is great. Electric power supply conditions are good. (2) A certain foundation already exists for the chemical fertilizer industry. Places fairly close to mine areas or having fairly convenient transportation can lay a fine foundation for further expansion of production. (3) Much can be done to tap potential and expand. In 1979, for example, the autonomous zhou's nitrogenous fertilizer output was only 62.4 percent of its production capacity. Expansion of the western Hunan region's chemical fertilizer industry is still unable to satisfy needs for the region's development of agriculture. For example, at an average 51.5 jin per mu of cultivated land area, Qianyang Prefecture's chemical fertilizer production in 1979 was able to satisfy only 26.7 percent of the region's needs for nitrogenous fertilizer (193 jin per mu). Future development of the region's chemical fertilizer industry will require full tapping of existing chemical fertilizer industry potential. It will have to tap potential and improve existing plants and

mines, and use the abundant chemical ore resources within the region to expand production. At the same time, in order to deal with western Hunan's sparse population relative to cultivated land, and the dispersed nature of farming, it will have to develop actively compound chemical fertilizers, mixed chemical fertilizers, and long acting chemical fertilizers.

6. Transportation

Range follows range in the western Hunan mountain region, and the valleys are deep with river rapids. Up until the time of liberation, only narrow, twisting trails led out of the mountains and everything was carried on backs and shoulders. Large amounts of native produce rotted while goods needed for daily life could not be carried in. "A dou of rice had to be exchanged for a jin of salt." Peoples of all nationalities suffered from being cut off from transportation, which also restricted the exchange of goods within the region. The self-sufficiency nature of agricultural production was also closely related to this situation. After liberation, the Hunan-Guizhou Railroad and the Jiaozuo-Liuzhou Railroad were built. The Hunan-Guizhou Railroad started at Zhuzhou in the east going westward to Guizhou and traversing Xinhua, Xupu, Chenxi, Huaihua, Zhijiang, and Xinhuang in the middle of the region en route, intersecting the Jiaozuo-Liuzhou Railroad at Huaihua. The Jiaozuo-Liuzhou Railroad crosses Shimen, Cili, Dayong, Yongshun, Guzhang, Jishou, Fenghuang, Mayang, Huaihua, Huitong, Jingxian, and Tongdao counties in this region and goes on to Liuzhou in Guangxi Province. It crosses the Yuan Shui at Qiancheng and the Li Shui at Shimen. Highways now connect all counties, and most trunk line highways have been oil coated. Dredging has removed rapids from streams permitting navigation over long distances. The situation where western Hunan had been cut off from the outside world has been preliminarily changed. Western Hunan is the province's major timber forest base, fresh fruit base, and animal husbandry base. Transportation of bulky, clumsy products such as timber and of fresh or live produce such as fruit and livestock is steadily improving. The change from being cut off from transportation has been extremely beneficial to the overall development of western Hunan's farming, forestry, and animal husbandry, and to the tapping of production potential. First of all, the passage of the Hunan-Guizhou Railroad through the northern forest zone in the upper reaches of the Yuan Shui has linked Dajiangkou, Huomachong, and Yuanshui, shortening the distance required for the transportation of timber. The Jiaozuo-Liuzhou Railroad, which crosses the forest region in the upper reaches of the Yuan Shui has become an artery for the transportation of timber from the forest area. Secondly, construction of the railroads has given powerful impetus to further development of the region's farming, forestry, and animal husbandry. It has accelerated development of the western Hunan region's natural resources, transformed unfavorable natural conditions in the western Hunan region, and played an important role in making fullest use of favorable conditions. It should be fully realized, however that this region's high mountains, deep valleys, and dispersed parcels of cultivated land still make transportation and communication relatively difficult. Further improvement in this region's transportation remains an urgent and arduous task.

Second Section. Agricultural Production Characteristics

1. Great Potential for Land Use, Primarily for Mountainlands

A look at the structure of land use in western Hunan (Table 121) shows 70 percent of the region's total area consisting mostly of mountainlands as being used for forestry. The western Hunan region has 26,778,900 mu of barren mountains and cut-over land, and about 10 million mu of grasslands suitable for pasturing. This represents 31 percent of the western Hunan region's total land area. Reserve land resources are plentiful for the expansion of forestry and pasturelands, and this is the region in the province with greatest potential for future development of forestry and animal husbandry.

Numerous communes and brigades in the western Hunan region are making full use of mountainlands for development of mountain region agriculture. Changgupu Production Brigade in Cili County is using as drylands 865 of its 980 mu of cultivated land, which are "squeezed in around four gorges, three bends, and a stretch of flat land" among a thicket of rocks. This is 88 percent of its total cultivated land area. Aojiahu Production Brigade in Guzhang County is using mountainlands to develop tung oil, tea oil, and timber, and is intercropping woodlands with grain and pulse crops, turning disadvantages to advantage. Renjian Production Brigade in Qianyang County is emphasizing both grain and fruit. It is growing citrus on mountain sides making sure that the fruit does not vie with grain for land. By using hills to make citrus groves, this brigade, which formerly had only 36 mu of citrus, now has 650 mu. If citrus trees growing in the four besides [beside streams, villages, roads, and houses] are included, it has 700 mu. These communes and brigades have planted on mountain sides some highly adaptable cash crops such as fruit trees and woody oil-bearing plants, and their tapping of mountainland potential to make barren mountains green, build timber forest bases and develop the mountain region economy is correct.

In western Hunan, the multiple cropping index is 227 percent, and in 1979, 45 percent of the wetlands area was planted to two crops of rice. This is the region of the province with the least double cropping of wetlands. In 1979, this region accounted for 59.77 percent of the province's single rice crop area, making it the greatest single rice crop growing area in the province.

Looked at in terms of forestland and cultivated land yields per unit of area, a very great potential exists for raising this region's land utilization rates. Timber reserves in the region average only 4.3 cubic meters per mu. Guangping Commune in Huitong County planted superior varieties of China fir forests, realizing timber reserves averaging 30 cubic meters per mu. Grain yields are also low, with late rice in a double crop system averaging 431 jin per mu, and early grain averaging 228 jin per mu. Spring and summer harvests of miscellaneous grains other than wheat and rice average only 118 jin per mu. In 1979, cotton yields averaged 77 jin per mu and rape yields averaged 110 jin per mu. Clearly both grain and cash crop yields per unit of area are relatively low, and a very great potential exists for increasing yields per unit of area.

Table 121. Table Showing Structure of Land Utilization in the Western Hunan Region

	(a) 土地利用类别	(b) 面积 (万亩)	(c) 占湘西区土地总面积比重 (%)	(d) 占省内同类土地总面积比重 (%)
(e)	土地总面积	11970.92	100	37
(f)	农业用地	1697.27	14.2	
(g)	其中：耕地	1297.27	10.8	
(h)	水田	937.08	7.8	
(i)	旱土	360.19	3	
(j)	宜农荒地	400.00	3.3	
(k)	林业用地	8442.65	70	45
(l)	其中：有林地	4217.44	35	38
(m)	用材林	2858.65	24	42
(n)	经济林	1041.14	8	33
(o)	油桐	220.30	1.8	96
(p)	油茶	694.75	5.8	28
(q)	茶叶	62.56	0.5	25
(r)	竹林	317.64	3	35
(s)	楠竹	264.01	2.2	32
(t)	疏林地	562.60	4.5	48
(u)	灌木林	893.83	7	61
(v)	未成林造林地	90.89	1	60
(w)	荒山迹地	2677.89	23	53
(x)	宜牧草地	1000.00	9	
(y)	水面	500.00	4	
(z)	其他	331.00	2.8	

Note: Cultivated land based on Statistical Bureau data; use of land for forestry is data from a provincial Department of Forestry survey; grasslands suitable for pasturage, water surface, and wastelands suitable for farming are estimated figures that are provided solely for reference.

Key:

a. Kind of land utilization
b. Area (10,000 mu)
c. Percentage of total land area in western Hunan region
d. Percentage of total land area of same kind in province
e. Total land area
f. Land area used for farming
g. Including: cultivated land area

h. Wetlands
i. Drylands
j. Wasteland suitable for farming
k. Land used for forestry
l. Including: wooded land
m. Timber forests
n. Economic forests
o. Tung oil
p. Tea oil
q. Tea
r. Bamboo forests
s. Nan bamboo
t. Sparsely wooded forests
u. Scrub forests
v. Immature afforested lands
w. Barren mountains and cut-over lands
x. Grasslands suitable for pasturage
y. Water surfaces
z. Other

2. Basis for Mountainland Farming and High Marketable Rate for Forestry Production

The western Hunan region holds an important position within the province for mountainland-based forestry, dryland grain production, the raising of cattle, sheep, and goats, and the growing of medicinal herbs. In 1979, the region produced 45.9 percent of the province's total output of dryland grain. This included 91.2 percent of the province's total output of corn, and 32.2 percent of its total output of gaoliang. It produced 25.1 percent of the province's total soybean output. It is a major dryland grain producing area in the province. The table below (Table 122) shows the region to have a very high percentage of the province's area sown to dryland grains.

The region grows 37.3 percent of the province's cattle and 65.7 percent of its sheep and goats. The reasons it has become a sheep and cattle production area for the province are as follows: Cattle are ruminants, each head equipped with its own "fermentation tank" that is able to make effective use of coarse fodder with small needs for grain. Sheep and goats also tolerate coarse fodder. Their pasture grass utilization rate is high, and their resistance to disease strong. The western Hunan mountainlands cover a vast area, and the grassland area is large. Wild fodder is abundant, and conditions for development of sheep and cattle are good. Quality of the region's oxen is generally quite good, and places like Sanjiaguan in Dayong, Luota in Longshan, Kuzhuping in Sangzhi, and Hejiashan in Cili counties are noted for their production of large oxen, and stock is plentiful for the breeding of superior oxen breeds.

Forestry holds a prominent position in the province. The timber forest and economic forest area covers 42,174,400 mu, which is 45 percent of the province's total forest area. Timber reserves amount to 110 million cubic meters, which is 60.2 percent of timber reserves for the province as a whole. In 1976, timber output amounted to 54 percent of the provincial total. Twenty-six of the province's 47 counties that supplied 10,000 cubic meters of timber annually were in western Hunan, making this region the province's principal area for the production of timber and nan bamboo. Western Hunan is also a citrus and woody oil-bearing plant production area. In 1979, the region had 34.17 percent of the province's citrus growing area, and accounted for 33.34 percent of its output. Its output of tung oil accounted for more than 85 percent of the provincial total. Output of rosin, tallow, and walnuts

Table 122. Table Showing Structure of Area Sown to Major Crops in Western Hunan in 1979

	(a) 项目	(b) 播种面积（万亩）	(c) 占总播种面积 %	(d) 占全省各类作物播面 %
(e)	总播种面积	2939.48	100	
(f)	一、粮食作物	2161.90	73.55	
(g)	1.稻谷	1288.54	43.84	
(h)	早稻	452.97	15.41	
(i)	中稻及一季稻	414.25	14.09	59.77
(j)	双季晚稻	421.32	14.33	
(k)	2.旱粮	873.36		48.63
(l)	小麦	161.47	5.49	
(m)	薯类	263.69	8.97	
(n)	杂粮	371.17	12.63	
(o)	其中：玉米	205.18	6.98	87.42
(p)	高粱	10.18	0.35	43.94
(q)	大豆	77.03	2.62	39.00
(r)	二、经济作物	224.32	7.63	
(s)	1.棉花	29.60	1.01	
(t)	2.油料	155.80	5.30	
(u)	3.烟叶	23.36	0.79	
(v)	三、其他作物	553.26	18.82	

Key:

a. Particulars
b. Sown area (10,000 mu)
c. Percentage of total area sown
d. Percentage of area sown to all crops in the province
e. Total area sown
f. I. Grain crops
g. 1. Paddy rice
h. Early paddy
i. Intermediate paddy and single crop paddy
j. Double crop late paddy
k. 2. Dryland grain
l. Wheat
m. Tubers
n. Grains other than wheat and rice
o. Including: corn
p. Gaoliang
q. Soybeans
r. II. Cash crops
s. 1. Cotton
t. 2. Oil-bearing crops
u. 3. Tobacco
v. III. Other crops

amounted respectively to about 70, 80 and 90 percent of the provincial total. Raw lacquer and Chinese chestnut output were respectively 42.2 and 70 percent of the provincial total. Timber forests are found mostly in the upper reaches of the Yuan Shui and in the middle reaches of the Yuan and Zi rivers. Economic forests are found mostly in the northern part of the region. The region's forestry has the following several features: (1) It is the most important timber and economic forest region in the province. (2) The timber forests are mostly pine and China fir, and the economic forests are mostly citrus and woody oil-bearing trees. (3) A fairly large percentage of the forests are mature, and numerous barren mountains are awaiting afforestation. (4) A great potential exists for development of traditional forestry products. The marketable rate for forestry products is highest among farming, forestry, and animal husbandry. The marketable rate for economic forest products such as citrus, tung oil, and tallow is greater than 90 percent. This is of great inter-regional significance, and some forest products play a role in exports.

3. Production Level Fairly Low, Unbalanced and Inconsistent

Up until the time of liberation, the western Hunan region was locked among three large mountains, was victimized by officials and bandits, had poor transportation, lacked labor forces, had a low technical level, farmed extensively rather than intensively, and harvested meager crops everywhere. After liberation, as a result of socialist reforms, the collectivization of agriculture, vigorous state support of minority nationalities, and development of transportation and industry, socioeconomic conditions for development of agriculture were fundamentally transformed. At the same time, new requirements were posed for western Hunan's agriculture, and agriculture began to change from extensive to intensive operations and very great development of agricultural production occurred.

Nevertheless, comparison with the western Hunan region with the province as a whole shows its level of agricultural production to be not only relatively low, but unbalanced as well. In 1979, grain yields averaged 187 jin per mu less than for the province as a whole; agricultural production conditions changed relatively slowly; and production was inconsistent. In 1979, the area of western Hunan from which a crop could be assured despite drought or waterlogging amounted to only 48.2 percent of the cultivated land area, 15.9 percent less than for the province as a whole. Only 27.1 percent of the cultivated land was fields producing consistently high yields. During the same year, only 7.62 percent of the cultivated land area was machine plowed, 15.38 percent less than for the province as a whole. During the great 1972 drought, grain yields in the Tujia and Miao Nationality Autonomous Zhou declined by about one-fifth from 1971. Timber reserves for the region figured in terms of timber forest area average 4.3 cubic meters per mu, lower than the national level. In Huitong County in the south, timber reserves average 8.5 cubic meters per mu, while in Huayuan County in the north, they average only 1.5 cubic meters per mu. Clearly a substantial potential exists for achieving balanced and increased yields per unit of area from this region's grain and timber reserves.

4. Good Conditions for the Integration of Farming, Forestry, and Animal Husbandry, and Wide Latitude for Economic Diversification

Conditions are good in the western Hunan region for the integration of farming, forestry, and animal husbandry, and wide latitude exists in economic diversification as manifested in the following principal ways:

1. Plentiful wasteland resources provide latitude in development of farming, forestry, and animal husbandry, and for launching economic diversification. There are 26,778,900 mu of barren mountains in the region, and more than 10 million mu of grassland suitable for the raising of livestock, so land resources for development of forestry and animal husbandry are widespread.

2. Great vertical changes in the natural environment and great regional variations suit the region for multi-faceted development of farming, forestry, and animal husbandry. Kinds of natural resources are numerous. The region has both sub-tropical plants and animals as well as temperate zone plants and animals. Vertical variations in atmospheric temperature, crop patterns, and great differences in multiple cropping and the cropping system enrich the content of farming.

3. A great potential exists for all-around use of forest, mineral, and water power resources. In western Hunan, forest, mineral, and water power resources are very abundant, and potential for their development and use is very great. Water power reserves stand at more than 8 million kilowatts of which less than 10 percent is presently being used. Fuller all-around use of forest, mineral and hydropower resources, and increase in the utilization rate of all three are important problems in future development.

A look at the actual circumstances of production in western Hunan shows without exception that the communes and brigades that have won fine achievements in production have been those that have adhered to the integrated development of farming, forestry, and animal husbandry, carrying into practice the principles of planting, raising, and processing. The experiences of these communes and brigades may be capsulized in four ways as follows:

First is adherence to the principle of linking farming, forestry, and animal husbandry so that there is no mutual competition in planning use of the labor force. In forest regions, competition for the labor force between farming and forestry is fairly pronounced. Agricultural production is strongly seasonal, while seasonality is also strong in forestry production. The time for transplanting crops is frequently precisely the right season for setting out seedlings. In order to solve the competition between farming and forestry for workforces, Guangping Commune in Huitong County organized special forestry production brigades with a fixed number of workers in them. The special felling teams of 17 production brigades took up only 4.6 percent of the commune's total workforce. Thus, not only was planning for the use of farming workforces not impaired, but state-assigned timber quotas were also fulfilled on time. In addition, felling and forest care could proceed at the same time. During the slack season in farming, farm workforces were organized

for mass land reclamation and afforestation. The principle of growing forests, fruits, and cash crops on mountainsides was adhered to in land utilization so that there was no competition with grain, forestlands were used to the full, and orchards could be intercropped. Guangping Commune used as yet unafforested lands to be newly afforested for the growing of grain, planting trees for afforestation in the following year. During the second and third years following afforestation, weeding and loosening of the soil was done twice annually in the sapling forests to help the saplings grow. In addition, grain or cash crops were intercropped in the woodland area. Renjian Production Brigade intercropped fruit orchards with oil-bearing crops, grain, and fodder in the intercropping of woodlands with grain, fodder, and cash crops, which also achieved very good results. Not only was there no competition for workforces, but the method helped the mutual advancement of farming, forestry, and animal husbandry.

Second, adherence to the principle of combining the use and nurture of resources, with emphasis on nurture. Guangping Commune focused on the growing of quick-growing high yield tree species and actively launched development of socialist large forests "so that the green mountains would long remain, and could continue to be used forever." Renjian Production Brigade and Lianhua Production Brigade took firm grip on the raising of superior citrus varieties and to increasing the supply rate for superior varieties of citrus seedlings as a means of expanding the scope of their operations. Renjian Production Brigade's collective hog farm made energetic efforts in the breeding of sows for an increase in the rate of supply of hog breeding stock, and assuring a proper proportion between the hog inventory and removal from inventory rate. It also steadily upgraded quality and quantity, assuring breeding stock for the expansion of reproduction.

Third, adherence to the principle of obtaining materials locally for development of commune and brigade enterprises. Commune and brigade enterprises in the region may be placed in the following three categories:

First is commune and brigade enterprises for direct development of farming, forestry, and animal husbandry, such as superior breed farms, livestock raising farms, forest farms, and gathering farms.

Second is enterprises that lay a foundation for direct promotion of the modernization of farming, forestry, animal husbandry, sideline occupations, and the fishing industry, such as hydropower stations, small coal mines, lime plants, and farm machine repair plants.

Third is commune and brigade enterprises that do processing of farm, forest, livestock, and sideline occupation products, such as plants for the processing of all sorts of farm, forest, livestock, and sideline occupation products.

All the raw materials and fuel that these various kinds of commune and brigade enterprises need are substantially supplied from local sources. The forest sideline products processing plant in Guangping Commune used sub-standard materials, tips and tail ends of trees, twigs and branches,

which were abundant in the commune, for processing into small farm tools and articles used in daily life thereby increasing the degree of all-around use of forest sideline products and economic benefits. The same commune's hydropower station made full use of abundant local hydropower resources to build power stations in conjunction with development of irrigation.

Fourth, adherence to the principles of suiting general methods to local situations and a rational pattern of distribution. The people of Xupu County combined development of traditional products with production of new products. Mountain region communes energetically developed production of timber, medicinal herbs, tea, tobacco, tea oil, and tung oil, while hill and plains communes actively developed production of cotton, citrus, tea oil, red dates, and silkworm mulberry with outstanding results.

Fourth Section. Distribution of Bases and Trial Delineation of Sub-Regions

1. Distribution of Bases

The western Hunan region can make full use of mountainlands, establishing production bases by suiting general methods to specific circumstances and making a rational pattern of distribution. One of the problems to be solved in selecting bases is what to develop. A second is where to carry out development? Third is how to develop bases? The problem focused on here is an exploration of the basis for base selection and evaluation of bases. First is the basis for base selection: (1) The possibility of building bases with effort to meet needs in development of the national economy. (2) Effective and feasible conditions for development, or a tradition in planting or livestock raising. (3) Fairly high level of marketable products or a great potential for increasing the marketable product rate. A fairly concentrated pattern of distribution or conditions for concentrating in continuous tracts. (4) Relatively plentiful varieties of resources, numerous superior breeds, or favorable conditions for the introduction of superior breeds.

The western Hunan region's existing bases have three features as follows: (1) A foundation for forestry bases. Examples include the timber forest base in the upper reaches of the Yuan Shui, the woody oil-bearing plant base in northwestern Hunan, and the citrus base in the valley of the Yuan Shui. (2) Tea and cotton bases tend to be on the eastern fringe of this region, most of them closely neighboring the same kind of bases outside the region, their interregional importance being greater than their importance within the region. (3) Animal husbandry bases are still in an incipient state.

Now let us explain below one by one existing bases in western Hunan as well as proposed plans for new bases:

(1) Forestry Bases

1. The timber base in the upper reaches of the Yuan Shui includes most of Tongdao, Jingxian, Huitong, and Qianyang counties, plus Suining and Chengbu counties as well as Naxi Commune in Dongkou County, an area totaling 21.91 million mu containing 52.24 million cubic meters of timber reserves, which is 23 percent of the province's total timber reserves. This region accounts for 28 percent of the province's timber output, and is a key forest area in the province as well as a major base for timber production. The central agriculture and forestry departments have classed development and construction of this forest zone as a large and a medium size state construction project. Forest resources may be characterized as follows: In its coniferous timber forest area, the area and reserves of masson pine and China fir forests predominate overwhelmingly. The masson pine area accounts for 63.8 percent of the total forest area, and masson pine reserves account for 53 percent of total reserves. Second comes China fir forests which account for 26.3 percent of the area and 25 percent of reserves. Most China fir forests have been man-made, but some have sprouted from trees that had

been cut down. There are numerous kinds of bamboo, with nan bamboo being the dominant large stem one. It is found over a wide area, and reserves number 102.87 million stalks. The percentage of mature forest resources is large, amounting to 86.9 percent of total forest timber reserves or 51.3 percent of the forest area. Middle age forests account for 11.1 percent of forest timber reserves and for 9.8 percent of the forest land area. Young forests contain 2 percent of forest timber reserves and cover 38.9 percent of the forest area. Today forests are concentrated mostly in places where transportation is not convenient and in remote mountain regions where assembly of timber on mountain roads is difficult. Timber resources are greatest in the basins of the Wu Shui and the Qu Shui where 43.3 and 40.07 percent of total timber reserves are located. Nan bamboo is found mostly along the main stream of the Yuan Shui and in the basin of the Wu Shui. These two places contain 46.91 and 23.95 percent respectively of the total amount of nan bamboo. In short, this forest region is characterized by a lack of diversification of tree varieties, a simple composition, numerous mature forests, and a large percentage of pine and China fir. This forest region has the following favorable conditions for development: (1) Natural conditions favor forest tree growth. The climate is temperate; rainfall is copious; relative humidity is high; the soil is fertile; and favorable conditions exist for development of quick growing, high yield timber forests. Under most conditions, mature timber can be available for use within 25 to 30 years. (2) In old forestry bases, the local people have a historical tradition in doing some forestry and some farming. They have created and accumulated abundant experiences in forest operations and in timber and bamboo production. (3) Species are fine. Firs from Guangping in Huitong County have been classed with China firs from Jinping in Guizhou and from Jianping in Fujian as the three fine firs in the country. Chinese larches from Suining are second only to those from northeast China. (4) Transportation in the forest region is convenient, and a preliminary highway network has been built in the forest zone. Today nearly 2,000 kilometers of through highways exist. The main streams of the Wu Shui, Qu Shui and Yuan Shui are also able to float timber. Costs are low and investment in capital construction slight. The Hunan-Guizhou Railroad passes close to the northern part of the forest zone. This provides conditions for shortening the distance timber must be transported by water at Dajiangkou, Huomachong and the confluence of the Yuan Shui. The Zhicheng-Liuzhou Railroad runs through the forest zone from south to north and has become a major artery for hauling timber out of the forest zone. This forest region has many mountains, many forests, and many fields. In addition, the period when the waters are right for the movement of timber is also the busy season in farming when there is a workforce shortage and conflicts between farming and forestry are pronounced. Consequently, hastening the mechanization of forest region forestry and agriculture and the modernization of communications and transportation hold extremely important significance. (Figure 61)

2. Proposal to make Yuanling and Anhua into timber forest bases. Plans call for the designation of a forest base centering around Yuanling and Anhua counties including parts of Guzhang and Xupu. Reasons are as follows: (1) A certain foundation in forestry already exists, and potential for development is great. Land used for forestry totals 12.58 million

mu of which 7.89 million mu is forestland. Forest reserves total 23.76 million cubic meters, and barren mountains suitable for forests total 2.53 million mu. Potential for development is great. (2) Mature forests predominate. Resources able to be used in the near future are abundant, and are urgently in need of development. In Yuanling County, for example, the mature forest area accounts for 45 percent of the county's total forest area and forest reserves account for 69.5 percent of its total timber reserves. (3) The Yuan Shui and the Zi Shui traverse the forest zone and the region is close to the Hunan-Guizhou and the Zhicheng-Liuzhou railroad lines. Both water and land transportation are convenient.

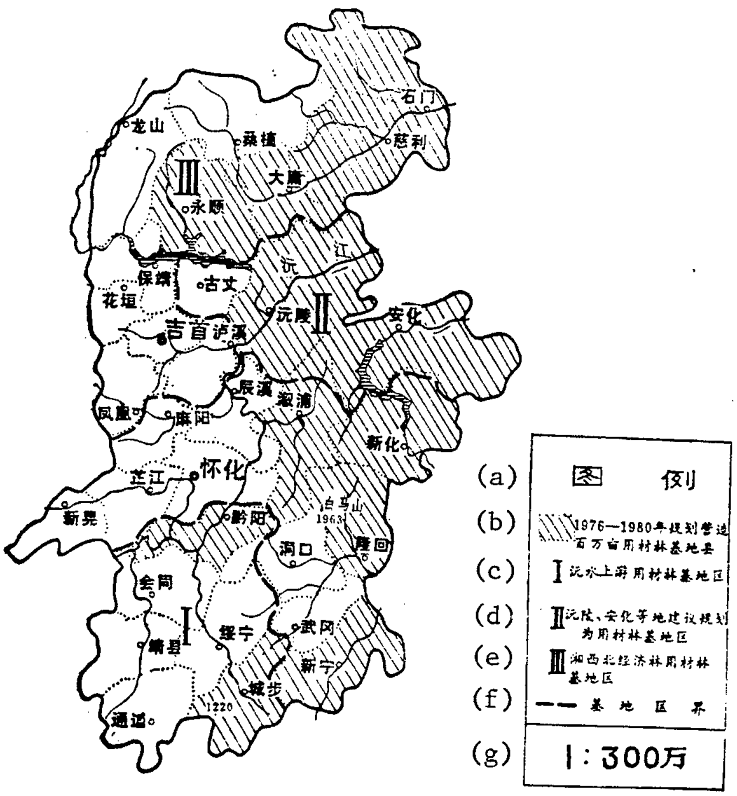


Figure 61. Forestry Sub-Districts of the Western Hunan Agricultural Region

Key:

- a. Legend
- b. 1 million mu timber forest base county planned for 1976-1980
- c. I. Timber forest base region in the upper reaches of the Yuan Shui
- d. II. Proposed plan for timber base region in Yuanling and Anhua
- e. III. Northwestern Hunan economic forest and timber forest base region
- f. Base demarcation lines
- g. 1:3,000,000

Building of this base requires the following: (1) Mostly afforestation with simultaneous afforestation and closing of the area to human intrusion for

building of a new forest zone that is mostly timber forests, but also has diverse kinds of trees in diversified forests. (2) Full use of favorable conditions along the Yuan and Zi rivers to build transportation lines that go through the forest zone. Building of a large hydroelectric power station at Wuqiangxi requires consideration of the building of facilities to move timber. At the same time, a low volume transportation line might be built from the forest zone to the Hunan-Guizhou railroad line to hasten movement of mature timber. (3) Building forests to prevent soil and water erosion on both banks of the Yuan Shui, You Shui and Zi Shui where soil erosion on slopes is serious. Suiting general methods to local situations to build forests to protect the banks near large and medium size reservoirs in the region.

3. Northwestern Hunan economic forest and timber forest base. Conditions favoring development of forestry within this region include the following: (1) The soil is mostly mountainland yellow earth ranging from neutral to slightly alkaline or very slightly acidic, making it suitable for the growing of tree species that like neutral to slightly alkaline soils such as tung, Chinese tallow, eucommia, lacquer, Chinese sumac, Chinese toon, cypress, and Corsiaria sinica. (2) Late rainy season. During July and August, precipitation is greater than 200 millimeters. Rainfall during July and August is ample and helps the fruiting of tung trees. In addition, the atmospheric temperature is high, and annual relative humidity is approximately 80 percent. Consequently, valleys with low slopes have fine conditions for the growth and development of tung and Phoebe nanmu trees. (3) The masses have plentiful experience in growing woody oil-bearing trees. In addition, tung trees produce results quickly and grain can be intercropped with tung trees, turning disadvantages into advantages. The cake residues resulting from pressing tung and Chinese tallow seeds also make superb fertilizer, and conditions for linking farming and animal husbandry are good. (4) Within the region, the basin of the Li Shui has high mountains and deep valleys. Torrential rains fall frequently during summer, but the forest cover rate is only 20 percent. In addition, most tung forests grow down slopes making for easy erosion and serious mountain floods. A great disparity exists in water levels between flood and low water periods. The erosion modulus for the Li Shui basin for many years has been more than 400 tons per square kilometer, making it one of the worst areas for erosion in the province. For this reason, special attention should be directed to development of forests that hold moisture and preserve soil and water. Development of forestry in this region requires: (1) Establishment of economic forest bases consisting primarily of woody oil-bearing trees. In Dayong County in the autonomous zhou, Shati, Xinqiao, Hezuoqiao, Zhonghu, Xinglong, Yuxi, Guanping, and Sanping communes have a tung area totaling 100,000 mu, most of it on the north bank of the Li Shui to the east of the Dayong County county seat. Zaguo and Neixi communes in Longshan County have an approximately 55,000 mu tung tree area. Xixi and Duishan communes in Yongshun County, Datuo and Huayuan rivers in Baojing, and Qietong and Duanlong communes in Guzhang all have tung oil bases. On the north bank of the Li Shui in the western part of Cili County, the tung trees of Yichongqiao, Yanbaidu, Ganyan, Yanghe, and Xujiachang communes are contiguous with the tung oil base in Dayong County. Tung trees are found at Nanyue, Sushi,

Moshi, Yanchiping, Suoshi, Yangliuyuan, Fengheping, Chuanshanhe, Hekou, Taipingjie, and Ziliangping communes in Shimen County. In western Hunan, most tung grows down slopes where erosion is serious. Furthermore, the soil erosion has made the soil infertile, and this has seriously impaired tung oil output. The previously outlined experiences of Cili County in preventing tung forest erosion should be spread. In Sangzhi County in the autonomous zhou, Guandiping, Mahekou, Furongqiao, Zhujiqiao, Ruitapu, Chengxiao, and Kuzhuping communes constitute a Chinese tallow tree base with 15,000 mu. In Cili County, Shanmuqiao, Sanguansi, and Yangliupu communes are Chinese tallow tree bases. These three communes account for 70 percent of the whole county's output of woody plant oils. Cili County's Zhufenqiu superior specie of Chinese tallow tree has numerous branches, large seeds and a thick waxy nature. Tea oil is produced mostly in Yongshun, Longshan, Dayong, and Cili counties. Tea oil is fairly widespread in western Hunan and concentrated on tracts except in the northern part of the western Hunan region. A substantial amount is grown in areas neighboring eastern Huaihua and southern Xupu. Lacquer comes from Daan, Bamianshan, Ciyan, Luota, and Sanyuan communes in Longshan County; from Jiwei, Bushu, and Yayou communes Huayuan County; from the Laer mountain region of Fenghuang County; from Chaoyang Commune in Baojing County; from Songbai Commune in Yongshun County; and from Daping and Yuanxi communes in Dayong for the most part. Coir fiber comes mostly from Wulixi and Sifang communes in Sangzhi County, from Huoyan Commune in Longshan County, from Paihou and Danqing communes in Jishou County, and from Longtan Commune in Fenghuang County. Regarding the distribution of economic forests within the region, the bases are less concentrated and linking of large crop areas is less (Figure 62). Forests of medicinal crops include magnolia bark and eucommia bark. (2) Use of quick growing tree species for afforestation to preserve soil and water. Quick growing tree species such as Coriaria sinica and oaks have well developed crowns, drop thick layers of leaves, and have highly developed root systems, that are useful in retaining soil moisture and preserving water and soil. Forests for the preservation of the soil against erosion should be designated from among existing forests and only small area cutting done in small areas of such forests. After cutting, afforestation should be done at once. (3) Rotated intercropping depending on soil quality: Farmland crops and pulse crops able to increase organic matter, as well as pulses and pasture grasses should be rotationally intercropped in order to preserve the soil, improve it, and make it able to hold moisture. This would help advance development of farming, forestry, and animal husbandry.

(2) Fruit Bases

In order to simplify the explanation, fruit bases have been omitted from the discussion of forestry bases and analyzed separately. Conditions in the western Hunan region for development of fruit are superb. 1) South of a line extending from Huitong to Dongkou in this region, absolute minimum temperature is a little higher than -9°C, making it a favorable area in the province for overwintering citrus. North of this line, the valley of the Yuan Shui is the second most favorable area for citrus. It has many places with a microclimate in which citrus can safely overwinter such as Chenjiahe Commune in Sanzhi County, and the area around the Longshan County county seat.

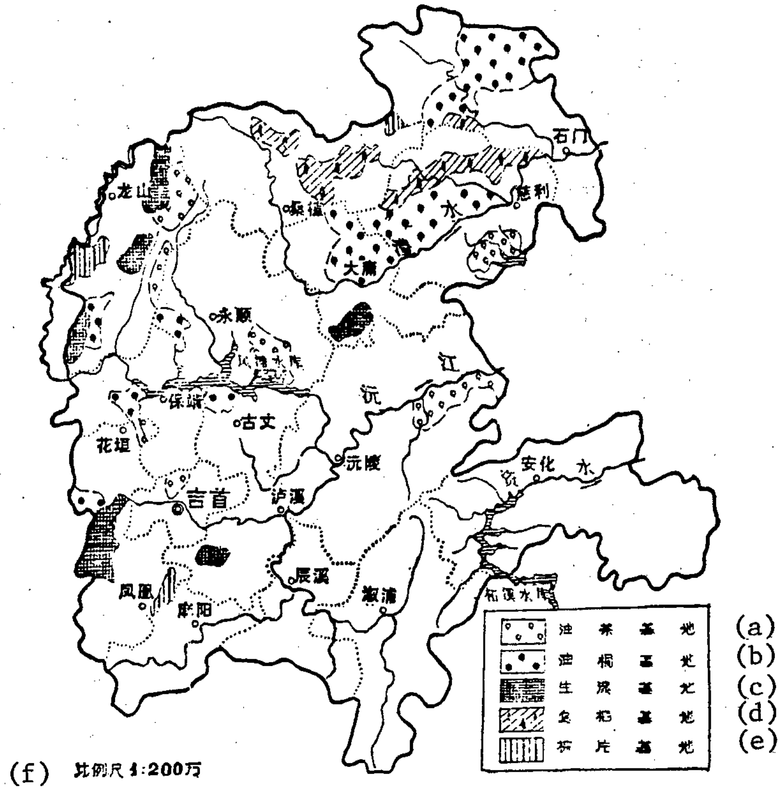


Figure 62. Distribution of Economic Forests in the Northwestern Part of the Western Hunan Agricultural Region

Key:

a. Tea oil base
b. Tung oil base
c. Lacquer base
d. Chinese tallow tree base
e. Coir fiber base
f. Scale: 1:2,000,000

2) The hill and barren mountain area suitable for development of fruit is vast. In the autonomous zhou and in Qianyang Prefecture, except for mountain tops above 600 meters, which are not suitable for citrus production, there are more than 700,000 mu of hills and mountain slopes where citrus may be grown. Conditions for growing citrus up mountain slopes are good, and the area on which citrus may be grown is more extensive than for other juicy and dry fruits. 3) Fruit resources are plentiful and species numerous. The Wuling and Xuefeng mountain regions have quite a few wild varieties or semi-wild varieties of citrus resources. Examples include Yichang oranges, Citrus junos, trifoliate orange, and Poncirus trifoliata. Some old growing areas experienced in growing and propagation have produced quite a few natural orange hybrids and mutants. As a result of meticulous, long-term culturing by the masses, there are numerous superior species such as red bayberries from Jingxian, and yangdong pears from Baojing. Superior varieties of citrus are particularly numerous and form a complete range. Plentiful varieties provide a favorable material foundation for development of fruit production. The key area for development of citrus is the old citrus bases in the valleys of the middle reaches of the Yuan Shui centering

around Xupu and Qianyang, and new citrus bases primarily at Dongkou and Xinning in the upper reaches of the Zi Shui. In these old and new citrus base areas, transportation is convenient, and development holds bright prospects. Yields per unit of area are also fairly high. Potential for expansion of citrus groves and propagation through layering is great. The major superior breeds that have been bred are already able to meet Hunan Province's various requirements. Local varieties have been preliminarily matched. There are early ripening superior breed mutants of Pushi seedless oranges, which fill a gap in early ripening superior varieties of sweet oranges, and which are of substantial significance in Hunan Province's future early supply of sweet oranges to markets. There are intermediate ripening rock sugar oranges [0393 4743 2892] that are sold fresh right after picking, and big red oranges that are sold fresh after being stored. Jingxian blood oranges [5877 2892] ripen late, becoming substantially ripe during the last 10 days of December under natural conditions in this region. They have firm fruit and tolerate storage. After storing, their flavor is full and sweet, and they are more fragrant. They are of very great importance in lengthening the province's period of supply of oranges to markets. They should be actively propagated, thereby making Jingxian into a supply base for superior varieties of sweet oranges. (Table 124, Figure 63)

Table 124. Outline of Superior Variety Sweet Oranges at Orange Bases in the Middle Reaches of the Yuan Shui

Name of orange	Strong points or characteristics
Pushi seedless orange	Fairly vigorously growing trees with strong resistance to cold. No cold damage under local natural conditions. Color is deep orange and skin is reddish orange. Flesh is slightly crunchy and somewhat aromatic. Skin is thin; flavor is very sweet and slightly acidic. No bitterness in fruit juice after heating.
Pushi seedless orange early ripening superior mutant	Maintains and develops the red-orange color of the fruit of Pushi seedless oranges. Attractive, thin skinned, no seeds and much juice. Increased amount of sugar and reduced acidity that enhances flavor. Particularly valuable since it ripens 1 month ahead of the other strain.
Rock sugar orange	Strong tolerance of cold; thin skin with few seeds; juice sacks are thin, long, and densely arranged. Flesh is fine and crunchy; flavor is extremely sweet.
Jingxian blood oranges	Vigorous growth, bumper producers, large fruit, red-orange color with large purple spots. Extremely attractive. Rich taste and fragrant. Ripen late; tolerate storage. Rich, sweet flavor after storage with enhanced fragrance. Of very great importance in increasing Hunan Province's supply of oranges to markets.

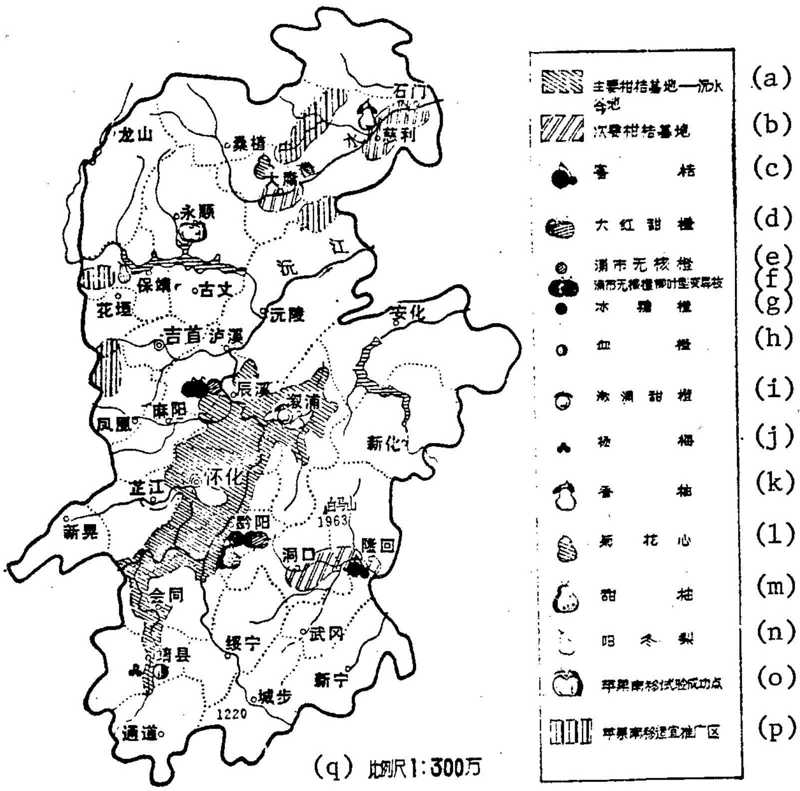


Figure 63. Map Showing Distribution of Fruit Bases and Superior Varieties in the Western Hunan Agricultural Region

Key:

a. Major citrus base--Yuan Shui valley
b. Secondary citrus base
c. Tangerines
d. Big red oranges
e. Pushi seedless oranges
f. Pushi seedless oranges, Liuye type mutant
g. Rock sugar oranges
h. Blood oranges
i. Xupu oranges
j. Red bayberries
k. Fragrant pomelos [7449 2680]
l. Chrysanthemum hearts [5468 5363 1800]
m. Sweet pomelos [3929 2680]
n. Yangdong pears [7122 0392 2746]
o. Sites at which apples have been successfully grown
p. Areas suitable for the southward spread of apples
q. Scale: 1:3,000,000

(3) Tea Bases

Tea is characterized by a long growing season, vigorous bud growth, and broad adaptability. However, during their growth season, tea bushes place fairly

high requirements on atmospheric temperature and soil moisture. During the summer and autumn drought season, water is the major factor in increasing tea yields, and is even more conspicuous in increasing autumn tea yields. Western Hunan with its many mountains, its large amount of rainfall, the small amount of evaporation, the fairly high humidity, and less summer and autumn drought than in the central Hunan hills has natural conditions more suitable for the growing of tea, and tea quality is higher. As farm mechanization increases and transportation becomes increasingly convenient, tea production may be expanded correspondingly. Competition for labor between grain and tea is not great in mountainlands where few double crops of rice are grown and where paddyfields are few, or in some flatland and hill regions where population is large relative to cultivated land. In such places, tea growing may be increased as feasible. In 1979, western Hunan had 625,600 mu of tea plants, or 25 percent of the province's tea plantation area. In 1979, its tea output amounted to 21.3 percent of the total for the province as a whole. Tea bases were located mostly in Anhua. In 1979, the tea plantation area at Anhua was 164,600 mu, or 26.3 percent of the total tea growing area in western Hunan. Tea output was 51.2 percent of the total for western Hunan. Anhua had a large output of tea, high yields per unit of area, and tea of good quality. Anhua Yuntaizhong is shrub-like, and its budding leaves contain varying degrees of anthocyanadin. It buds vigorously and makes red or black tea of fine quality. This is closely related to Anhua's natural conditions and social factors. Anhua is the part of the province that receives greatest rainfall, and an overwhelming majority of tea plantations there are located at between 250 and 800 meters above sea level. Seventy-four percent of the mountain slopes have a gradient of 30 degrees or less, so water drainage is rather good and meets tea plants' "need for water but fear of too much water." The temperature is right and wind velocity is low. Relative humidity is high (above 80 percent). The area has a long history of tea production and abundant experiences. Tea growing has also developed quickly at Dongkou, Xupu, Xinhua, and Longhui. Guzhang tea buds sprout during the first 10 days of March, and by the end of March one bud plus two or three leaves have developed. Most budding leaves are pekoe and suitable for making green tea of superb quality, but output is small. Guanzhuang in Yuanling County has been a noted tea producing area in need of further development. Future development of tea plantations in the vast mountainlands of western Hunan should meet requirements for mechanization of tea production and for bringing fields under irrigation. Places selected for tea plantations should be continuous tracts with a thick soil layer, protected from the wind, and on slopes of 30 degrees or less.

(4) Cotton Bases

In 1979, the western Hunan region planted 296,000 mu to cotton. This was 12.3 percent of the province's cotton growing area. It produced 227,500 dan of cotton, which was 12 percent of the province's cotton output for yields averaging 77 jin per mu, which were slightly lower than the average for the province as a whole. In the western Hunan region, cotton is grown over a dispersed area; however, within the region, cotton is grown mostly in Shimen and Cili counties, which are cotton bases for the western Hunan region. In 1979, these two counties grew 153,500 mu of cotton, or 67.5 percent of the

total area planted to cotton in the western Hunan region. Ginned cotton output was 191,700 dan, which was 84.3 percent of the gross cotton output for the western Hunan region, or an average yield of 125 jin per mu. This was higher than the average yield for the province as a whole. This cotton base neighbors the Liyang Plain cotton base in the lake region. Since it is located somewhat toward the northeast corner, it is somewhat distant from the region's cotton textile center at Anjiang. After the opening of the Zhicheng-Liuzhou Railroad, the importance within the region of the Shimen and Cili cotton bases increased. Xupu County produced more than 10,000 dan of cotton annually, mostly along the banks of the Xu Shui and along the Hunan-Guizhou Railroad line. Its interregional significance is not great.

(5) Ramie Bases

Ramie bases are located mostly in the autonomous zhou, and in Dayong, Fenghuang, Yongshun, and Luxi counties. Conditions in these places favoring the growing of ramie are as follows: (1) Early arrival of spring and an effective growing season that is longer than in northern Hunan, with slight changes in temperature. The mountain region has continuously rainy and overcast days with much mist and a low proportion of sunshiny days. Most of the time sunlight is diffused, and winds are slight. All these conditions help ramie grow. (2) The masses have experience in growing hemp. They plow moderately deep each year in the hemp growing area, and this helps withstand drought for consistently high yields. The ramie growing area of Fenghuang, Luxi, Yongshun, Dayong, and Sangzhi in western Hunan can be expanded as feasible. (Figure 64)

(6) Livestock Bases

The western Hunan region has many mountains, few fields, and plentiful grassland resources. A foundation already exists for cattle, sheep, and goat production. Conditions for raising grass-eating cattle, sheep, and goats are good. Suining, Chengbu, Xinning, Wugang, and Dongkou in Shaoyang Prefecture, as well as Shimen and Cili counties in Changde Prefecture, all have requisite conditions for development of cattle, sheep, and goat bases. Ten of the counties in the autonomous zhou have already been classed as national beef cattle bases. Plans call for Baojing, Yongshun, and Huayuan counties to go into production in 1980. Shimen County has been designated a sheep skin base. Full use may be made of the region's favorable conditions in having ample fodder for development of a rabbit raising industry. Wugan geese and Xupu geese are superior breeds that should also be developed actively.

The western Hunan region also has 5 million mu of water surfaces of which it has been estimated that approximately 500,000 mu have been stocked with fish. Qianyang Prefecture has 2.2 million mu of water surfaces of which approximately 230,000 mu may be used. As of 1974, less than 80,000 mu of its water surfaces had been stocked. This was approximately only one-third the usable water surface area. Fish yields averaged 25 jin per mu. Clearly the water surface utilization rate is still very low, and a very great potential exists for raising the water surface utilization rate. Use of water surfaces

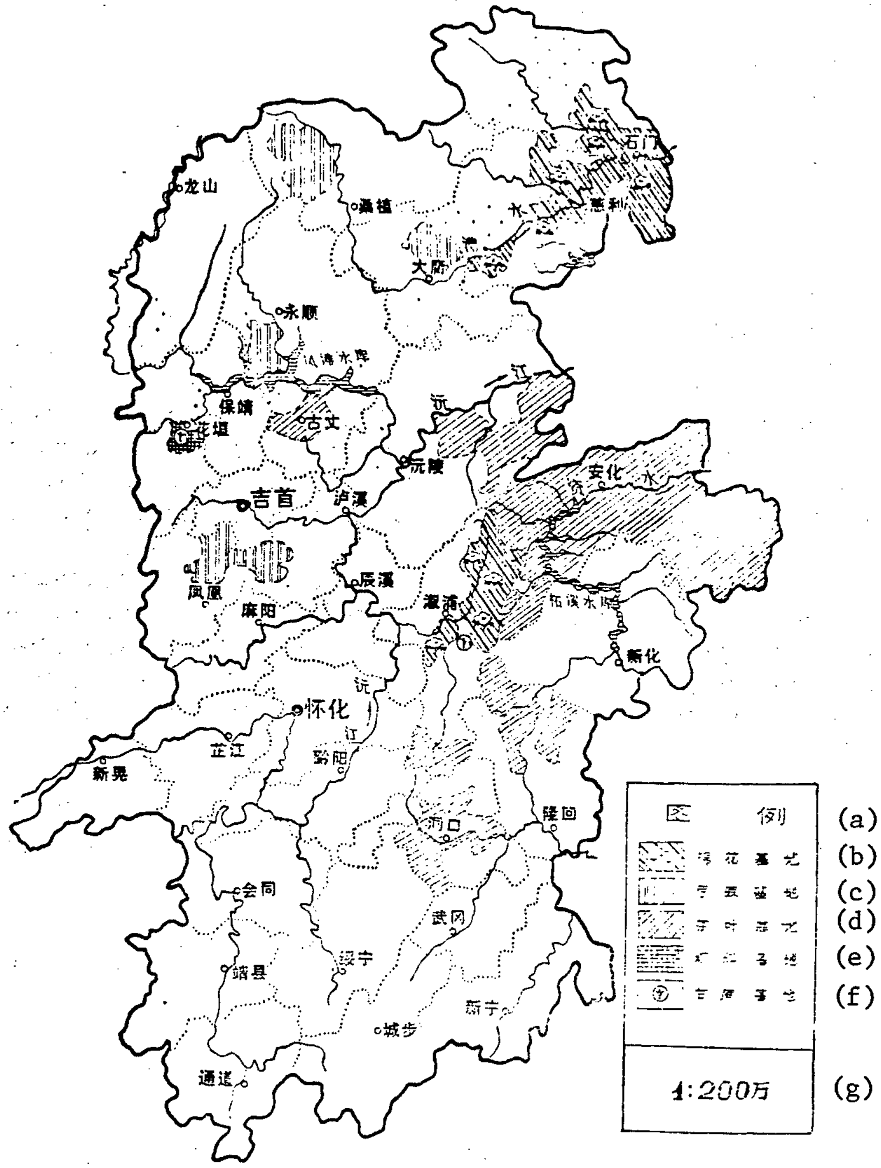


Figure 64. Map Showing Distribution of Cotton, Hemp, Teas, and Sugar Bases in the Western Hunan Agricultural Region

Key:

a. Legend
b. Cotton base
c. Ramie base
d. Tea base
e. Sugar base
f. Sugarcane base
g. 1:2,000,000

in the western Hunan region should be based on water surfaces being fairly concentrated, good quality water sources, and convenient transportation, with emphasis going to the building of a group of fry breeding bases. Artificial methods of stimulating production should be used to breed fish fry, and the problem of supplying fish fry should be solved locally. Since there are no facilities for the passage of fish at either the Tuoxi Power Station on the Zi Shui or the Qingshan Turbine Pumping Station on the Li Shui, migrating fish have no way to go upstream to breed. As a result, sharp decline has occurred in migratory fish in the western Hunan region. The area around Qingfeng on the Zi Jiang had been a spawning ground for black carp and grass carp. However, with the building of the Tuoxi Reservoir in 1960, which widened the river at the dam site, stabilized the water level, and slowed the current, black and grass carp have not been able to spawn. Thus, any future building of water projects should be based on the "three saves" principle. In addition to saving ships and saving timber, fish have to be saved too.

2. Trial Delineation of Sub-Zones

Trial delineation of western Hunan into five agricultural sub-zones has been done on the basis of regional variations in the region's natural conditions, social factors, and agricultural structure. (Figure 65)

(1) The Wuling Mountainland Dryland Grain, Economic Forest and Cattle and Sheep Growing Region

This region includes Shimen and Cili counties, a region with an agricultural population numbering approximately 3,885,500, and 4,567,200 mu of cultivated land, or an average of 1.2 mu of cultivated land per capita. The region has 32.07 million mu of land used for forestry, or an average of 9 mu per capita of land used for forestry. It has 10.4 million mu of forests of which economic forests account for 47 percent. It is the region in which the percentage of economic forests is highest. Barren mountains and cut-over lands cover 16.51 million mu, the largest amount in the province.

The proportion of drylands to cultivated land in western Hunan is greatest in this sub-region, and the percentage of wetlands used for double crops of rice is smallest in this sub-region. This sub-region has 1.74 million mu of drylands, which is 38 percent of the cultivated land area. Two crops of rice are grown on 28.2 percent of the wetland area. Many fields depend entirely on rainfall. Both paddy rice and dryland grain crops are important, and are of special significance in this sub-area. In 1979, the area sown to dryland grain crops amounted to 59 percent of the total area sown to grain, while output of dryland grain amounted to only 36 percent of the sub-area's gross grain output. Dryland grain yields per unit of area are low, and a great potential for development exists. It has conditions for being built into the largest dryland grain base in the province.

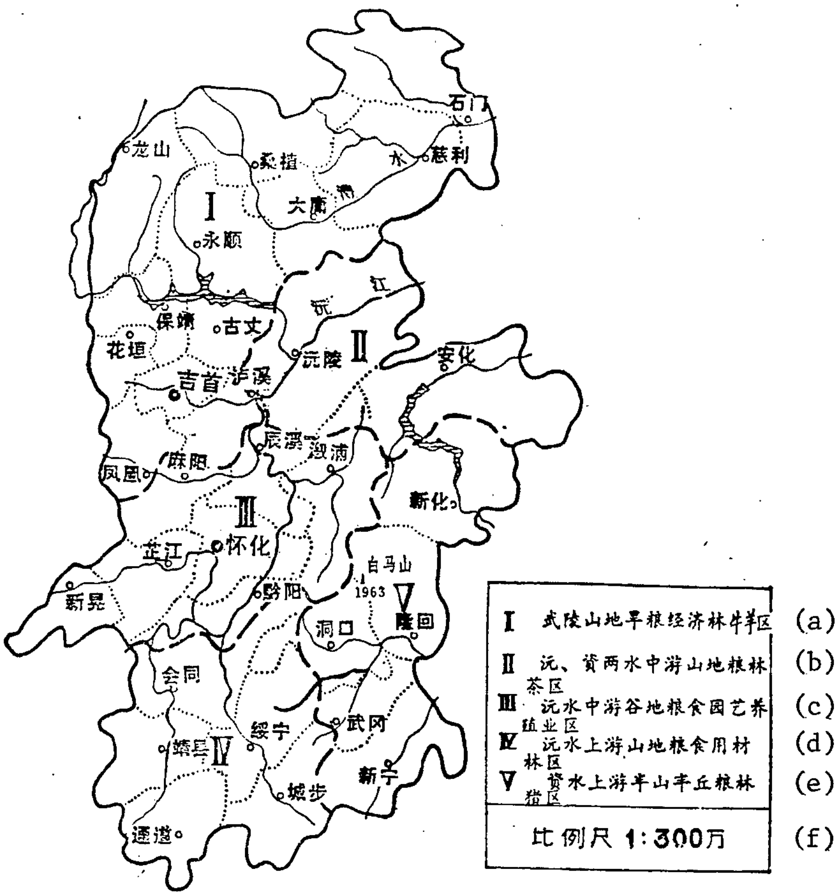


Figure 65. Sub-Zone Map of the Western Hunan Agricultural Region

Key:

a. I. Wuling Shan dryland grain, economic forest, and cattle and sheep growing region
b. II. Yuan and Zi rivers middle reaches mountainland grain, forest and tea growing region
c. III. Valley of the middle reaches of the Yuan Shui grain, horticulture and breeding industry region
d. IV. Yuan Shui upper reaches mountainland grain and timber forest region
e. V. Zi Shui upper reaches semi-mountain, semi-hill grain, forestry and hog raising region
f. Scale: 1:3,000,000

The growing of economic forests, and particularly of woody oil-bearing trees has a long history in this sub-region, which is famed as "the land of tung oil," and noted as a national tung oil producing area. A 1.8 million mu area in the sub-region is planted to tung trees. This is more than 80 percent of the province's total tung tree growing area. The sub-region holds first place in the province in output of tallow oil. In 1979, output of tea oil was 35.2 percent of the total for the western Hunan region. Citrus,

Chinese chestnut, and pear trees are plentiful. This sub-region has also been successful in the southward transplanting of apples. The area has a tradition in the production of lacquer, gallnuts, and coir fiber. Natural conditions are suitable for development of economically diversified forests. Since rainfall during August and September is fairly great, the sub-region is suitable for economic forests whose fruit output is paramount such as woody oil-bearing trees like tung and Chinese tallow trees, as well as woody food trees such as Chinese chestnut. Economic forests cover 4.94 million mu, which is more than 46 percent of the total economic forest area of the western Hunan region. Construction of the Jiaozuo-Liuzhou Railroad has provided convenient transportation for development of timber forests. Conditions are ripe in this sub-region for development of both economic and timber forests.

This sub-region has much drylands and is accustomed to the intercropping of corn and soybeans. The growing area is also large. In 1979, this sub-region grew more than 1.63 million mu of corn, which was about 80 percent of the corn growing area in the western Hunan region. It produced 408,990,000 jin of corn, which was more than 80 percent of the western Hunan region's gross output of corn. During the same year growing area and output of soybeans stood at 49.5 and 51.2 percent of the total for the western Hunan region. Clearly a very great potential exists for supplying a livestock industry with premium quality feed and green fodder. This sub-region also has a large expanse of grasslands, and experience in raising cattle, sheep, and goats is plentiful. It is an important area for the production of superior breed oxen. All the counties in the autonomous zhou in this region have been classed as national beef cattle bases, and Shimen has been classed a sheep skin base.

(2) The Yuan and Zi River Middle Reaches Mountainland Forest and Tea Growing Region

This region includes mostly Yuanling and Anhua counties. Population numbers 1.15 million and land area totals more than 16.11 million mu. Land used for forestry is 12.58 million mu, an average of 11 mu per capita of land used for forestry. The sub-region has 7.14 million mu of forests, or more than 6 mu per capita. Barren mountains and cut-over land runs to 2.1 million mu, and cultivated land to 1.38 million mu, an average of 1.15 mu per capita of cultivated land. Drylands account for 32 percent of the cultivated land area.

The wasteland area presently stands at about 2.53 million mu, and mountainland soil resources used for the growing of forests and tea are substantial. The climate is warm and humid with more than 200 millimeters of precipitation falling during August and September. This provides favorable conditions for a fall tea crop that amounts to about 20 percent of output for the whole year. However, during September, rainfall is less than 100 millimeters; thus serious attention must be given irrigation.

A foundation for forests and tea exists, and timber reserves are large. There is much mature timber awaiting cutting. There are 7.14 million mu of

forestlands, more than 78 percent of which contain timber. Timber reserves amount to 23,766,300 million meters, or an average of 20 cubic meters per capita. Thirty-nine percent of this is China fir, and 40 percent is masson pine. There are many mature forests. Yuanling County alone accounts for 69 percent of the county's total timber reserves [sic]. The tea plantation area in this sub-region covers 285,000 mu, and in 1975, tea output was 104,400 dan. This sub-region had 42 percent of the western Hunan region's total tea plantation area and about 70 percent of its output.

Both the Yuan and Zi rivers traverse this sub-region, and great potential exists for improvement in shipping lanes and upgrading water transportation. The Zhicheng-Liuzhou Railroad goes through Guzhang, and the Hunan-Guizhou Railroad goes through Anhua. The building of a transportation line connecting the railroads with the mainstreams of the Yuan and Zi rivers would solve the problem of transporting timber out of the sub-region.

Numerous large and medium size hydropower stations such as the Tuoxi power station, the Fengtan power station, and the planned Wuqiangxi power station are located in this sub-region. Power needed for the mechanization of farming, forestry, and animal husbandry can be supplied from nearby. There are numerous large reservoirs, and a great potential exists for the rearing of fish in reservoirs.

(3) The Valley of the Middle Reaches of the Yuan Shui Grain, Horticulture and Breeding Industry Region

This region includes Xupu, Chenxi, Huaihua, Mayang, and Zhijiang counties, plus the western part of Qianyang County, plus Huaihua and Hongjiang cities. The agricultural population is 2.15 million. There are 2.59 million mu of cultivated land, or 1.2 mu per capita. Sixteen percent of the cultivated land is drylands. Forty-two percent of the wetland area grows two crops of paddy.

The terrain is relatively low and flat, and there are the Xupu, Huaihua, Zhijiang, and Anjiang basins in which there are numerous low hills and downlands providing latitude for development of horticultural farms. Conditions exist for the building of fodder bases in the hills. The Hunan-Guizhou and the Jiaocheng-Liuzhou railroads intersect here, making very convenient the prompt shipment of fresh fruits, fresh vegetables, and fresh or live livestock.

This is the major sweet orange producing area of the province, and it has a long history of production. Superior varieties are numerous and complete. Overwintering conditions for sweet oranges are fairly good. Though the absolutely lowest temperatures since meteorological records began to be kept occurred in early 1977, the probability of such an occurrence is slight at approximately 4 percent. Furthermore, advantage may be taken of microclimates. In early 1977, the absolute lowest temperatures in Xupu County was -13°C; however, not far away in Jiangkou District, the temperature was only -8°C. Within the region, the growing of Chinese honey oranges is progressing gradually.

Sources of electric power are nearby; population is large relative to cultivated land, and the number of plants and mines, cities and towns is on the increase providing plentiful workforces and power for an intensive horticultural industry and a modern breeding industry, while supplying markets at the same time.

Within the sub-region, 13.45 million mu of land is used for forestry. This averages out to 6 mu per capita. Forestland covers 7.04 million mu and timber reserves amount to 16.81 million cubic meters. A definite basis for a forestry industry exists.

(4) The Yuan Shui Upper Reaches Mountainland Grain and Timber Forest Region

This region includes Huitong, Jingxian, Tongdao, Suining, and Chengbu counties as well as most of Qianyang County and Naxi Commune in Dongkou County. It has a 1.1 million agricultural population and 1.43 million mu of cultivated land, or 1.33 mu per capita.

It has numerous mountains, numerous forests, and numerous fields. The following table shows the area of various kinds of land use within the sub-region (Table 125):

Table 125. Table Showing Various Kinds of Land Areas in the Upper Reaches of the Yuan Shui

	名 (a) 称	面 (b) 积 (万亩)	(c) 占土地总面积 %	(d) 人平亩数	备 (e) 注
(f)	林业用地	1808.56	82.32	8.4	包括荒山迹地 (j)
(g)	农业用地	209.09	9.52	1.9	包括宜垦荒地 (k)
(h)	其它用地	179.34	8.16	1.7	
(i)	土地总面积	2196.99	100		

Key:
- a. Designation
- b. Area (10,000 mu)
- c. Percentage of total land area
- d. Mu per capita
- e. Remarks
- f. Land used for forestry
- g. Land used for farming
- h. Land used for other purposes
- i. Total land area
- j. Includes barren mountains and cut-over land
- k. Includes reclaimable wasteland

Forestlands average 17 mu per capita, and timber reserves average 57 cubic meters per capita. Nan bamboo averages 100 stalks per capita. The area has a long history in the development of forestry, and abundant experience in forestry operations. Natural conditions also favor development of timber forests such as pine and fir. Great prospects exist for the development of forestry. In this region, cultivated land averages 1.33 mu per capita. This includes wastelands suitable for reclamation. Land used for farming averages 1.9 mu per capita, the highest amount in any of the sub-regions. Drylands account for 9 percent of the cultivated land area, the lowest amount

for any of the sub-regions. Grain yields per unit of area are low, but the average amount of cultivated land per capita is fairly great. Great potential exists for improving the marketable grain rate.

The forest cover rate is high, and the percentage of mature forests is large. The forest cover rate is 63 percent, and 86.9 percent of total timber reserves are mature forests. The pine forest area is large accounting for 63.8 percent of the timber forest area. China fir forests cover 26.3 percent of the timber forest area. Consequently, major tasks in the development of forestry in this sub-region are accelerated exploitation of mature forests, afforestation of barren mountains and improvement of sparsely forested lands, and expansion of China fir forest afforestation.

The large amount of forests and cultivated land places fairly heavy burdens on the workforce, and conflicts between farming and forestry are fairly prominent. Quickening the pace of farming and forestry mechanization in this sub-region is a major way in which to solve the competition for labor between farming and forestry for all-around development of farming, forestry, and animal husbandry.

The Zhicheng-Liuzhou Railroad runs south to north. In addition, tributaries of the Yuan Shui, plus the Qu Shui and Wu Shui travel through the forest region. Both water and land transportation are at hand, providing convenient conditions for the shipment of bulky, heavy timber and nan bamboo.

(5) The Zi Shui Upper Reaches Semi-Mountain, Semi-Hill Grain, Forestry and Hog Raising Region

This region includes Xinning, Wugang, Dongkou, Longhui, and Xinhua counties. It has an agricultural population of 3.17 million. Its land area totals 19 million mu. Cultivated land amounts to 3.2 million mu, 28 percent of which is drylands. Ten million mu is used for forestry. This averages to about 3 mu per capita of forestlands, the least of all the sub-regions in the western Hunan region.

The average amount of cultivated land per capita is small, but the proportion of wetlands used to grow two crops of paddy is large. In this sub-region, cultivated land averages about 1 mu per capita, the smallest amount of all the sub-regions of the western Hunan region. Seventy-three percent of the wetland area grows double crops of paddy, the highest of all the sub-regions. The double crop rice growing area is located mostly in flatland and hill areas where the land is broad and sunshine abundant.

Water resources from the mainstream and tributaries of the Zi Shui are abundant, and water power reserves fairly large. There are numerous sites suitable for the building of dams for reservoirs. Karst water is plentiful and conditions are good for the multiple use of both surface and ground water. Potential is great for development of water conservancy and hydropower.

A definite basis exists for combining the growing of grain and hogs. This region grows 30 percent of the western Hunan region's hogs, each mu of cultivated land supporting an average of 0.7 head of hogs, the highest amount for any of the sub-regions of the western Hunan region. Three counties in the sub-region, namely Xinhua, Longhui, and Dongkou, annually provide the state with more than 100,000 head of hogs. Mountainlands in the southwestern part of this sub-region are fairly vast and grassland resources substantial. This area also has conditions for development of a cattle raising industry.

A definite basis already exists for development of fruit and tea growing. In 1977, almost 50,000 mu was devoted to the growing of citrus, and citrus output stood at 72,000 dan. Dongkou and Xinning are the citrus base counties in the province. Dongkou, Wugang and Xinning all have requisite conditions for the overwintering of Chinese honey oranges and favor development of citrus production. Xinhua and Dongkou have already become tea base counties for the province. In this sub-region, nan bamboo reserves amount to more than 110 million stalks, which is 13 percent of the province's total nan bamboo reserves, a fairly good foundation. Full use of this sub-region's large population relative to cultivated land and its ample workforce requires active use of barren mountains and cut-over lands (approximately 2.5 million mu) for the growing of fruit, tea, nan bamboo, and timber.

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